

EFFECTIVENESS OF COMPREHENSION MONITORING STRATEGIES IN EFL OF NON-BILINGUAL SPANISH UNIVERSITY STUDENTS READING SCIENCE TEXTS

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Abstract: This paper studies the differences in the effectiveness in the use of Comprehension Monitoring (CM) when reading expository Science texts in Spanish (L1) and in English (as a foreign language). The sample was made up of Spanish university students with elementary, intermediate and advanced English proficiency levels. A reading-for-understanding task was proposed to students. We embedded local and global inconsistencies in the texts. The detection of the inconsistencies was used to assess CM ability when students tried to build the semantic representation of the text in L1 and in L2. Results showed that L1/L2 differences in the effectiveness using CM ability significantly diminished as the English proficiency increased. Using the CM in Spanish as a baseline for CM in English, we observed a gradual enhancement of transfer from L1 to L2 as the English proficiency improved.

Key words: *English as a foreign language, Spanish university students, reading comprehension, comprehension monitoring, science texts.*

Resumen: Estudiamos las diferencias en la efectividad del control de la comprensión (CC) en la lectura de textos de ciencias en español (L1) y en inglés (L2). La muestra se compuso de estudiantes universitarios españoles con niveles elementales, intermedios y avanzados de inglés a quienes se propuso una tarea de comprensión lectora. Se insertaron en los textos inconsistencias locales y globales. La detección de las inconsistencias se utilizó para evaluar el CC cuando los estudiantes intentan construir la micro y la macro-estructura del texto en L1 y L2. Los resultados muestran que las diferencias L1/L2 en el uso del CC disminuyeron significativamente conforme aumentaba el nivel de inglés. Utilizando el CC en español como referencia para el CC en inglés, observamos una mejora gradual de la transferencia de L1 a L2 al aumentar el nivel de inglés.

Palabras clave: *Inglés como lengua extranjera, estudiantes universitarios españoles, comprensión lectora, control de la comprensión, textos científicos.*

1. Introduction

With the integration of Spanish universities in the European Higher Education Area (EEES, <http://www.ehea.info/>) the knowledge and acquisition of foreign languages, especially English, becomes essential in the academic context of present-day university students. English is necessary not only to communicate in daily life but also to develop and apply knowledge in labour contexts.

Therefore, many Spanish universities are implementing English teaching within their educational policies and are starting to offer the possibility of studying some of their degrees in English. In that way, specific and specialized knowledge usual at university could be acquired in English and could be used later in the European market.

Much of university information is presented by means of expository texts. Understanding these texts in English (as a foreign language) demands certain linguistic competences -certain knowledge of vocabulary and grammar- and also particular cognitive and metacognitive skills (Oxford 1990).

Since Alderson (1984:23) posed the question “Is reading in a foreign language a reading problem or a language problem?” it is accepted that the reading comprehension ability in L2 has two main components: a) a linguistic component, based on lexical and syntactical knowledge in L2, related to L2 proficiency, and b) a cognitive component, based

on general reading skills, irrespective of the language that is being read in (Carrell 1991). In the Spanish context Linde (2008) proved that L2 reading comprehension cannot be explained properly using only a linguistic component, the grammar knowledge in L2 (only a 31% of the variance was explained). Therefore, reading strategies have to be considered as well. Some studies have focused on the development and use of metacognitive strategies in L2 (O'Malley and Chamot 1990, Oxford 2011).

Different hypotheses have been largely accepted in L2 reading research (Bernhardt and Kamil 1995):

1) The “Linguistic Interdependence Hypothesis” (LIH) or “Reading Universal Hypothesis” (Goodman 1971 and 1973, Cummins 1979, Esling and Downing 1986, Bernhardt and Kamil 1995) claims that readers may transfer the general reading skills acquired in L1 to L2 reading.

2) The “Language Threshold Hypothesis” (LTH) or “Short Circuit Hypothesis” (Cziko 1978, Clarke 1979 and 1980, Benedetto 1984 and 1985) states that only when the level of command in L2 exceeds a certain value or ‘threshold’ can general reading skills be transferred to L2 reading. Transfer is not expected below this critical value but it is expected from the threshold and beyond.

These two hypotheses assume that reading strategies developed in L1 can be transferred to L2 under certain conditions (Koda 1990, Schoonen, Hulstijn and Bossers 1998, van Gelderen, Shoonen, de Glopper, Hulstijn, Simis, Snelling and Stevenson 2004). Experimental data has shown that the percentage of reading comprehension variance in L2 explained by reading strategies is variable ranging from 6% to 25% (Bernhardt and Kamil 1995 and references there in, Lee and Schallert 1997, Schoonen *et al.* 1998, van Gelderen *et al.* 2004 and 2007, Tsai, Ernst and Talley 2010, Guo and Roehrig 2011). It depends on how the different variables are defined in an operative way (for example, the “linguistic components” as vocabulary or grammar knowledge, or the “proficiency level”, etc.), but also on the participants’ academic level, their socio-cultural context or the kind of tasks proposed.

The aim of this paper is to investigate the transfer from Spanish (L1) to English (L2) of a metacognitive reading strategy, Comprehension Monitoring, in Spanish university students with different L2 proficiency levels.

1.1. Comprehension monitoring when reading a text for understanding

Unlike learning at compulsory education, great part of university learning is autonomous. Thus, learners are totally responsible of their own learning and they have to decide what, where, when and how to learn according to their own goals. In this context, metacognitive skills become very important since they are the processes that allow the subject to internally control his/her own learning and to have at his/her disposal the necessary means to overcome the obstacles which he/she may find (Wagoner 1983, Baker and Brown 1984, Carrell, Pharis and Liberto 1989, Pressley and Afflerbach 1995, Auerbach and Paxton 1997, Alexander and Jetton 2000, Kolic-Vehovec and Bajanski 2007). Metacognitive strategies have been proved to be very important not only for reading comprehension (Zabruky and Ratner 1986, Otero and Campanario 1990, Otero, Campanario and Hopkins 1992, Campanario and Otero 2000) but also for academic success in general. Wang, Haertel and Walberg (1993) performed a meta-analysis taking into account the variables which have an influence on students’ academic achievement and they found that metacognitive variables were the second most important ones, after classroom management variables but before didactic and instructional variables.

Comprehension Monitoring (CM from here onwards) is the ability of a reader to be aware, while reading, whether a text is making sense or not (Flavell 1981, Brown, Bransford,

Ferrara and Campione 1983). In L1, good CM is associated with good reading comprehension (Zabruky and Ratner 1986, Kinnunen and Vauras 1995, Campanario and Otero 2000).

We will use the cognitive theory of reading comprehension by Kintsch and van Dijk (Kintsch and van Dijk 1978, van Dijk and Kintsch 1983, Kintsch 1998). This theory defines comprehension as the construction of mental representations on given information. Three different levels of mental representations are defined. Firstly, the Lexical or Surface representation, in which words are encoded and it is dependent on the specific grammatical forms used in the text. Vocabulary knowledge is essential. Secondly, the semantic or Textbase representation is associated to meaning, i.e. to the propositions in the text, and therefore does not take into account the concrete form used for writing the text. The construction of the text micro and macro-structure is a necessary step to build the Textbase representation. Micro-structure construction implies that the reader is trying to establish local coherence in the text, and the macro-structure construction implies establishing global coherence among text ideas. Lastly, the referential or Situation Model representation is constructed by actively linking ideas in the text with prior knowledge via inferences.

Otero and Graesser (2001) showed that the obstacles students found when they monitored their understanding of textual information could be classified according to the same three levels. Thus, comprehension can be monitored at lexical, semantic and also referential levels. In the present study we will focus on the semantic representation or Textbase, which seems to be a necessary step to reach the referential representation, or Situation Model (Vidal-Abarca and Sanjosé 1998). Specifically, we will study the effectiveness in the use of CM to establish local and global text coherence.

Casanave (1988) claimed that the study of CM in L2 was a “neglected essential”. Some empirical studies obtained measures of CM in L1 as well as in L2 in linguistic contexts different from the Spanish one. Block (1986 and 1992), Morrison (2004) and also Han and Stevenson (2008) found that comprehension monitoring was better in L1 than in L2, and they argued that these differences could be explained by the level of reading proficiency in both languages. In fact, the dependence of the effectiveness in the use of metacognitive strategies with the L2 proficiency has obtained some evidence in many studies. In the papers by Guo and Roehrig (2011) and by Lee and Schallert (1997) the use of metacognitive strategies (supposed to be language-independent) shared a significant percentage of variance with the proficiency level in L2 (correlation of around .4 to .5), indicating a co-linearity between both factors, i.e. the effectiveness in the use of metacognitive strategies when reading in L2 seemed to be related to the level of L2 proficiency. Harris and Grenfell (2004) concluded in their study that students with high linguistic proficiency levels tended to use more metacognitive strategies than students with lower proficiency levels and they were also able to transfer more metacognitive strategies from their mother tongue to English.

From these precedents subjects with low L2 proficiency are expected to show low effectiveness in the CM use in L2, compared to the one in L1. Conversely, subjects with high L2 proficiency levels are expected to show a high CM effectiveness in L2.

Two main approaches have been used to measure CM effectiveness. The first one proposes comprehension tasks to subjects and then ask them to self-assess their performance. These scores are compared to external, objective assessing measures. Subjects’ CM effectiveness is related to their accuracy in their self-assessing scores (Wagoner 1983, Maki 1995). The second one is based on the ‘Error Detection Paradigm’ (Baker 1979 and 1985, Baker and Anderson 1982, Winograd and Johnston 1982, Baker and Brown 1984). The main idea is to use embedded errors in the information provided to subjects, and then to propose comprehension tasks to them on the altered information. It is assumed that the higher the

amount of errors correctly detected by a subject, the higher his/her CM effectiveness will be. In the present study we will use this second approach.

1.2. Transfer of CM strategy

According to the Error Detection Paradigm, we will relate the CM effectiveness to the ability to detect the semantic mismatch between two contradictory or inconsistent ideas. Taking this into account, how does transfer of the CM strategy operate in cognitive terms? Usually researchers refer to more or less ‘transfer’ when they observe that subjects use a certain reading strategy in a more or less effective way in L2 compared to L1. Observable results, however, can be due to varied cognitive processes. Detecting an inconsistency or a contradiction between two ideas when reading a text implies two mental processes at least: 1) representing in mind each of the two inconsistent ideas properly; and 2) comparing them. When one of these two cognitive operations failed, the inconsistency would not be detected. Vosniadou, Pearson and Rogers (1988), in a detailed study considering different kinds of inconsistencies, found that children had no problems to compare two contradictory or inconsistent ideas when both were well represented in mind. Problems in detection were due to failures building the representation of one of the implied ideas. Otero and Kintsch (1992) also associated failures detecting inconsistencies to inappropriate representation of one of the inconsistent ideas, and not to the ability to compare two incoherent propositions when they have been well represented in mind.

Therefore, in this paper we will accept that the particular ability to compare two ideas – the second process mentioned before- in L1 is very similar to the one in L2, i.e., it ‘transfers’ from L1 to L2. However, there would still be L1/L2 differences in the CM effectiveness if the mental representation of the ideas in L2 was poorer than the representation of the ideas in L1. We will refer to ‘observable transfer’ when we deal with the final results coming from the comparison of the CM effectiveness in L2 to the one in L1. The ‘observable transfer’ involves the two previously defined mental processes operating together.

According to this approach, subjects with a high L1 command but low L2 proficiency, having difficulties in lexical access and/or syntax relations, parsing, etc., will not elaborate suitable semantic representations of the text. In this case, they could not properly monitor their comprehension of complex ideas in L2, or link them to establish global coherence. Thus, the ‘observed transfer’ of the CM at this semantic level should be low. When the L2 proficiency level is high and complex text ideas can be processed without difficulties, subjects could monitor their comprehension of these complex ideas in L2 and then, the L1/L2 differences in CM at this level should tend to vanish.

This relationship between low language command and language processing based on low-level linguistic components, was stated long time ago (Perfetti 1985) and applied to explain some difficulties in L2 acquisition (Fukink, Hulstijn and Simis 2005, Taguchi, Gorsuch and Sasamoto 2006, Koda 2007).

1.3. Hypothesis

According to the previous discussion, our prediction is: non-bilingual students with an elementary or intermediate L2 proficiency level will use CM in L2 in a less effective way than in L1 when they try to build the Textbase representation. This result has been obtained in previous studies and in other linguistic contexts with different L1s and L2s. Nevertheless, in subjects with high language domain in L2, we expect the CM effectiveness in L2 will be similar to the one in L1.

We formulate the following hypothesis:

H1. *Non-bilingual, university students' CM effectiveness in L2 will be lower than the one in L1 when their L2 language proficiency levels are low or intermediate. Thus, the 'observed transfer' will be poor in these subjects. As students' English proficiency level increases, the effectiveness in the use of CM in L2 to build the Textbase representation will become more similar to the one in L1.*

In order to test this hypothesis, we conducted a within-subject experiment with university students as previous studies had done (Morrison 2004, Han and Stevenson 2008). University students are supposed to have a proficient command of their L1 and good reading strategies in their mother tongue, including CM. Anyway, we will contrast this assumption in this paper and study the degree to which CM is transferred from L1 to L2.

To assess the effectiveness using CM we will propose a reading-for-understanding task to students using texts, both in L1 and in L2, containing some embedded errors. We will compare the CM effectiveness in L2 to the one in L1, so students' effectiveness in the use of CM in L1 will be our baseline. Comparing CM in L2 to that in L1 in a quantitative manner we will obtain some information about the percentage of successful observed transfer from L1 to L2 of this metacognitive strategy, at least in the task proposed.

2. Method

2.1. Participants

Initially, one hundred and ninety-nine male and female Spanish university students aged 20-28 participated in the study. However, we obtained complete data from 159 students, who finally made up the sample. These students belonged to six intact groups at an Infant and Primary Teachers' Faculty in a big Spanish city. This university Grade lasts four academic years and includes content specific subjects, such as science, maths, history, etc.; languages (Spanish and a foreign language, predominantly English); and education subjects, such as Pedagogy, Educational and Developmental Psychology, Instructional Methods, etc. Participants were in their second year of the Grade. They studied English as a foreign language but they exhibited different levels of proficiency (see *Materials, Variables and Measurements* sub-section). In Spain students have to reach an advanced level in Spanish to enter university, corresponding to the CEFRL C1 (Council of Europe 2001) or higher. Moreover, they studied the subject matter *Spanish Language for Teachers* in their first year of the Grade. Therefore, we assumed that participants had a proficient command in Spanish.

2.2. Design and variables

The independent variable was the English proficiency. This variable was expected to be a predictor of the effectiveness using CM ability. The dependent variables were the Comprehension Monitoring scores in Spanish and in English which were obtained from the completion of an error-detection task (see below). We obtained a CM measure in L1 and also a CM measure in L2 from every participant. Thus, we used a within-subjects experimental design. Finally, we computed the ratio CM-English/ CM-Spanish to define an 'index of observed transfer' of CM ability from Spanish to English.

2.3. Materials and Measurements

We defined our variables in an operational way, so they are associated to the instruments used and the measures they provide:

1) English Proficiency. – The Oxford Online Placement Test (OOPT) was used (<http://www.oxfordenglishtesting.com>, Pollit 2009, Purpura 2010). The OOPT scores range from 0 to 120 and they are associated with the level of English proficiency according to the Common European Framework of Reference for Languages, (CEFRL, Council of Europe 2001): A1 (0-19), A2 (20-39), B1 (40-59), B2 (60-79), C1 (80-99) and C2 (100-120). We selected the “Use of English” score provided by the OOPT as this one is related to reading skills. The “Use of English” part of the OOPT consisted of between 25-30 questions designed to assess students’ knowledge of vocabulary and grammatical forms and meaning (explicit, intended, and implicit). The tasks contained information related to commonly used contexts in daily communication.

2) Reading Comprehension Monitoring.– We prepared a pack containing the instructions followed by 6 expository texts (3 in English and 3 in Spanish). We selected expository texts instead of narrative texts as they are free from ambiguities which could cause inconsistencies due to literary styles. Texts were taken from university entry exams and were adapted to suit our purposes.

In order to ensure instrument reliability, we controlled the structure of the six texts, their length (between 210 and 230 words), the reading difficulty of the English texts, and the similarity between the English and the Spanish texts. We originally selected 10 English texts and modified them so that they all had the same structure. Each one was divided into three paragraphs. Paragraph one contained the introduction to the topic; the middle paragraph added more details or varied opinions about the topic; and the last paragraph was a summary of the text using macro-ideas. The reading difficulty of these texts was tested using a two-way protocol. To begin with, we used the Flesch-Kincaid Readability Scale (2010) to set the difficulty scores at between 60 and 70. This score range represents texts that would be easily understood by English pupils in Years 8 and 9 (Flesch 1948). Next, two different experts level-graded each English text, in accordance with the European Reference Level guidelines. We selected only the texts with a level range of between A2 and B1. Finally, we were left with six English texts which satisfied the two reading difficulty conditions. These 6 final texts were revised by a British bilingual teacher who suggested some changes to make expressions sound more authentic. We subsequently selected three of these six texts at random and translated them into Spanish to obtain 3 English and 3 Spanish texts as similar as possible (see Appendix).

According to the ‘Error Detection Paradigm’, the last step consisted of modifying the texts so that they contained 2 micro and 2 macro-level errors. The micro and macro-level errors were designed in line with the previously mentioned theory of reading comprehension (Kintsch 1998). Micro-level errors always consisted of adding an adjective to a noun which would give an illogical meaning, for example: “*hot* ice” or “*rocky* living beings”. This meant changing the meaning of the clause or simple idea. These micro-errors were “external inconsistencies” requiring rudimentary prior knowledge, as in Han and Stevenson’s (2008) work. Micro-level errors were always positioned in the central paragraph in our study, leaving the introductory paragraph free of mistakes. Macro-level errors consisted of modifying two macro-ideas in the closing summary paragraph, so that they would explicitly contradict some of the ideas in the text. For instance, in the text about the Evolution of the Species we introduced the macro-idea: “*All living beings have developed from many kinds of ancient life forms*”, which was inconsistent with ideas in the text stating that the species developed from only *a few kinds of living beings*. Readers did not need other ideas but the

ones explicitly expressed in the text to detect macro-errors. These “internal inconsistencies” were also used by Han and Stevenson (2008).

A key-code was provided on how to classify the different underlined information. This key-code was used by participants to write (1) under nonsense or absurd information; (2) under incoherent information; and (3) under unknown words. In this way, we discriminated between CM at the semantic level and CM at the lexical level.

We checked the instructions and the 6 texts with two subjects who were not in the sample. As a result, the instructions were modified and some micro-errors were substituted following their suggestions.

The variables measuring the effectiveness in the use of CM in L1 and L2 were defined as *the total amount of correctly detected semantic inconsistencies in each language* (‘CM-English’ and ‘CM-Spanish’). Each text had 4 embedded errors and there were 3 texts in each language. Thus, the scoring in this variable ranged from 0 to 12 in each language.

To assess the extent to which CM transfers from L1 to L2, we defined a new variable computing the ratio CM-English/CM-Spanish. In that way we considered the CM in Spanish as a ‘baseline’ to compare the effectiveness in the use of CM ability in L2.

2.4. Procedure

The activity was introduced as research into improving science texts for educational purposes, as they are usually difficult to understand for many students. To justify the use of English texts, an explanation was given to students about the integration of Spain in the European Higher Education Area (<http://www.ehea.info/>). The experiment took place during usual science lessons and was also useful for students’ learning. Participants were awarded a bonus mark which would be added to their final grade at the end of the course.

We needed two class sessions to obtain all the measures. The first session was dedicated to measuring students’ English proficiency levels (20-35 min). The second session focused on the CM measures in both languages. The written instructions (in L1), along with an example for practice, were given out to participants prior to them receiving the texts. One of the researchers read the instructions out loud and gave a model answer in the example task. Special emphasis was made on how to use the word underlining key code. This code was present throughout the experiment and could be freely consulted.

Participants were asked to judge and classify the difficulties they found in understanding the texts in order “to improve them for educational purposes” (subjects were pre-service teachers, so this would seem logical to them). However, they were explicitly warned both, in the written and oral instructions, that they could find different “comprehension obstacles, inconsistencies, contradictions, absurd information or nonsense words” depending on each person’s criteria and knowledge. They were also told that some of them may find some texts comprehensible and therefore they would not need to underline anything. We did not describe the task to students as an “error seeking activity” to keep the experimental reading conditions as natural as possible. In this way our instructions were different to Morrison’s (2004) and Han and Stevenson’s (2008), in which participants were explicitly asked to find the errors embedded in the texts. Students’ doubts were resolved before giving texts out.

We expected better error detection performance in Spanish, so previously having worked on a text in their own language could have alerted students to be extra-aware in their checking for similar errors in the English texts. To avoid this spurious extra-awareness we gave out the 3 English texts first. The English texts were handed out in a counter-balanced order and retrieved on completion so that students could not go back to the previous text.

When the 3 English texts had been done, we followed the same procedure with the 3 Spanish texts. There was no time limit set and the whole session took less than 90 min.

3. Results

3.1. English proficiency

The English proficiency score fitted a normal distribution (K-S: .789; $p = .562$). The mean value (SD) was 53.8 (20.8). The sampling distribution in line with the European Reference levels was A1: 5.2%; A2: 19.6%; B1: 38.6%; B2: 23.5%; C1: 13.1%; C2: 0%. Thus, 24.8% of the students in the sample were in the Elementary A1 or A2, 62.1% in the Intermediate B1 or B2 and 13.1% in the Advanced C1. There were not any participants on the C2 level.

3.2. Comprehension Monitoring

Table 1 shows the mean values and standard deviations for the number of correctly detected embedded semantic inconsistencies in L1 and L2.

	Levels according to CEFRL					
	A1	A2	B1	B2	C1	Global
CM-English	1.3 (1.7)	2.1 (1.7)	3.4 (2.2)	4.9 (2.4)	8.3 (1.9)	4.0 (2.9)
CM-Spanish	8.8 (1.8)	8.8 (2.0)	9.5 (1.6)	9.2 (2.5)	10.4 (1.9)	9.4 (2.0)
Spanish-English differences in CM	7.5 (1.8)	6.7 (2.1)	6.1 (1.9)	4.3 (3.1)	2.1 (1.8)	5.4 (2.8)

Table 1: Mean values (and SD) for the comprehension monitoring measure in each of the English proficiency levels.

To contrast hypothesis H1 we performed non-parametric statistics because our variables were not normally distributed according to the Kolmogorov-Smirnov test ($p < .05$).

The Spanish-English differences in the CM diminished as the English proficiency increased, as it can be seen in Table 1. The Kruskal-Wallis test showed that the English proficiency level had a significant effect on the L1/L2 differences in CM ($\chi^2(df=4) = 49.307$; $p < .001$).

Additionally, the CM global score in L1 was significantly higher than the CM global score in L2 (Wilcoxon test, $Z = -10.379$; $p < .001$). In the highest English proficiency level (C1), we obtained the smallest L1/L2 differences in CM, but they were still significant ($Z = -3.538$; $p < .001$).

Table 2 shows the Spearman's correlations between the considered variables.

	1.English prof	2.CM-English
1.English proficiency	1.00	
2.CM-English	.65 **	1.00
3.CM-Spanish	.23 **	.44 **

Table 2: Spearman's correlations between the considered variables. (**) $p < .001$.

The correlation between CM-English and English proficiency was significant and moderate: students having the highest English proficiency also showed the most effective use of the CM strategy reading in English. The CM-Spanish was significantly correlated to English

proficiency as well but the Spearman's ρ was clearly smaller. CM-Spanish was also significantly correlated with CM-English.

Correlations in Table 2 suggested considering the English proficiency score and the CM-Spanish together to explain the variability of CM-English. A percentage of 53% of the CM in English was explained by these predictors together. Table 3 shows the parameters of this regression.

Dependent Variable: CM-English	B	S.E.	β	t	Sig.
(Constant)	-4.350	.816	---	-5.333	.000
English proficiency	.085	.008	.620	10.871	.000
CM-Spanish	.405	.082	.281	4.924	.000

Table 3: Parameters in the linear regression for the English use of CM strategy at the semantic level.

Next, we compared CM-English with CM-Spanish, i.e. we took the CM measure in Spanish as the baseline. In that way, we obtained a kind of 'index of observed transfer' for this particular strategy. Figure 1 shows the change of the (CM-English/CM-Spanish) ratio as the English proficiency level increases.

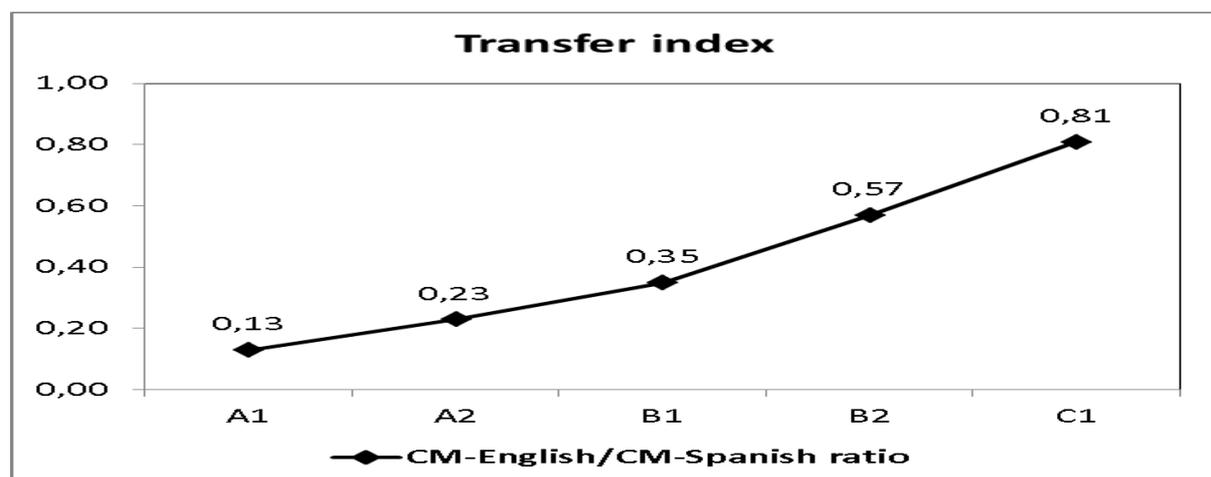


Figure 1: Mean values for the CM-English/CM-Spanish ratio in each English proficiency level.

This 'index of observed transfer' (the CM-English/CM-Spanish ratio) was distributed according to a normal curve (K-S: $Z= 1,205$; $p> .10$) and was significantly correlated to the English proficiency score (Pearson's $r= .62$; $p< .001$) indicating that the higher the proficiency the more effective the CM transfer.

Finally, we look into the data in a more detailed way. When the English proficiency level increased, the percentage of detections at the lexical level (number of underlined words, coded as "3") in the target sentences diminished, and, at the same time, the percentages of correct detections at the semantic level (coded as "1" or "2") increased. This behaviour is shown in Figure 2.

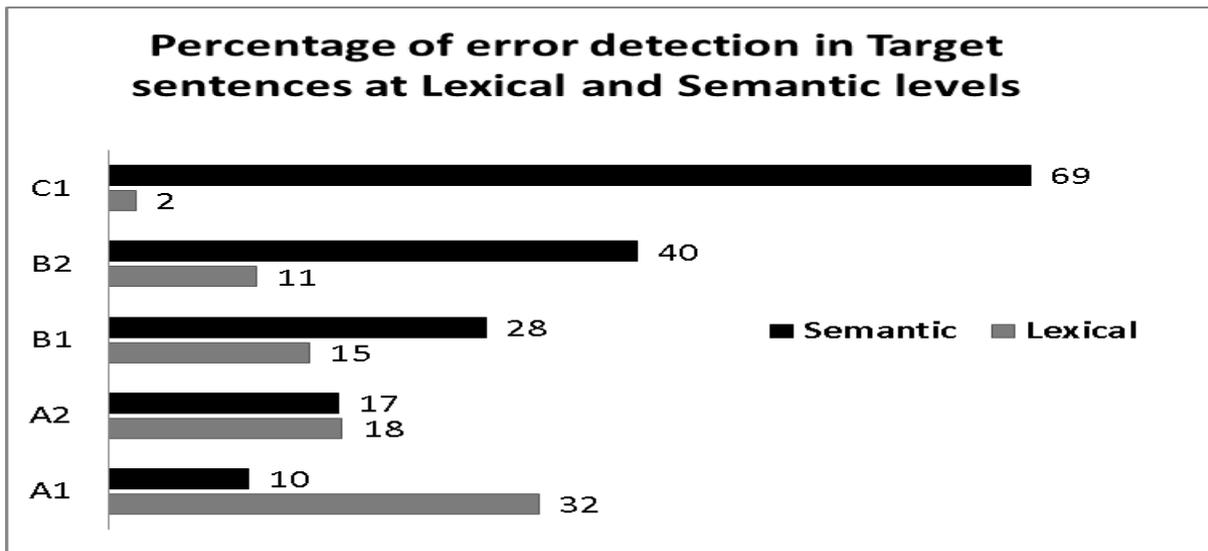


Figure 2: Percentages of lexical and semantic-level underlining in target sentences of English texts.

The English proficiency level was also associated to the absence of any detection in target sentences. As Figure 3 depicts, the absence of detection of micro-structural and macro-structural embedded errors tended to diminish as the proficiency level increased. More interestingly, Figure 3 also shows that the embedded macro-structural inconsistencies resulted more difficult to detect -i.e. there were more absence of detection- than micro-structural inconsistencies in all the proficiency levels.

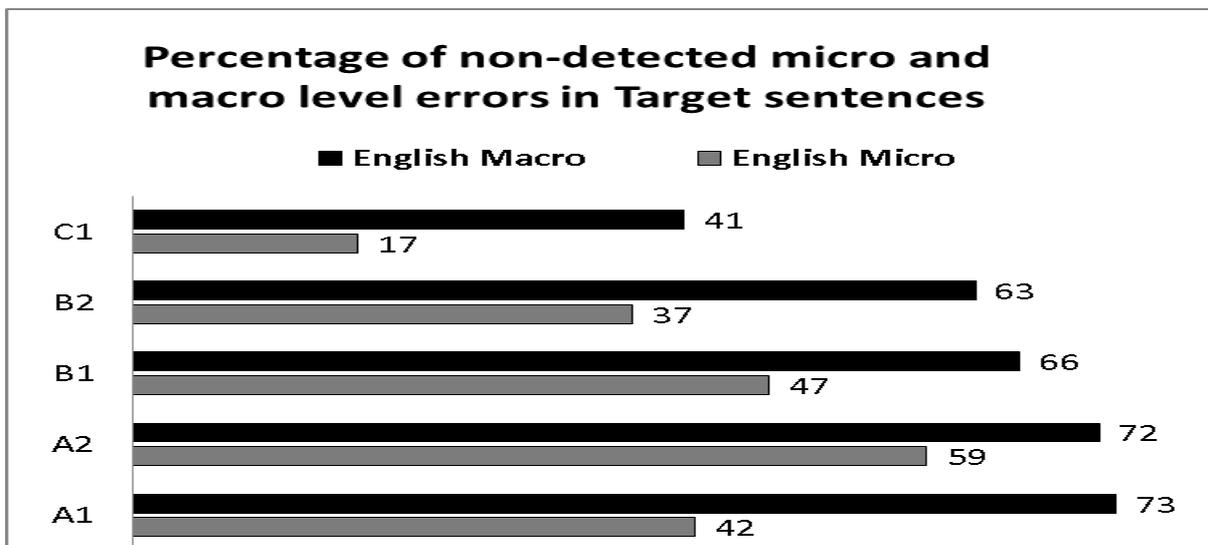


Figure 3: Percentages of absence of any type of underlining in target sentences, i.e. those including micro-level inconsistencies or macro-level inconsistencies in English texts.

Trends in Figures 2 and 3 show that the A1 students detected less semantic obstacles than the B2 or C1 students, and most of those detected obstacles were of lexical nature. Inversely, the B2 or C1 students made more micro or macro detections of embedded errors than detections of unknown or incomprehensible words. Therefore, students having low L2 proficiency levels seemed to have more difficulties establishing global coherence among text macro-ideas than students with higher proficiency levels.

4. Discussion and Conclusions

In this empirical study we focused on a particular reading ability: the effectiveness in the use of comprehension monitoring to establish local and global text coherence, necessary to build the Textbase, or the Semantic mental representation. We measured this reading ability by means of the detection of embedded inconsistencies when reading-for-understanding general science texts. Our participants were Spanish university students with different levels of L2 proficiency.

We formulated the following hypothesis:

H1. Non-bilingual, university students' CM effectiveness in L2 will be lower than the one in L1 when their L2 language proficiency levels are low or intermediate. Thus, the 'observed transfer' will be poor in these subjects. As students' English proficiency level increases, the effectiveness in the use of CM in L2 to build the Textbase representation will become more similar to the one in L1.

We obtained several evidences from data analyses. First, statistical analyses confirmed that the effectiveness in the use of CM at the semantic level was significantly lower in L2 than in L1 in our sample. Students with elementary and intermediate English proficiency levels monitor their understanding better in L1 than in L2. This expected result represents a replication of previous work (Block 1986 and 1992, Morrison 2004, Han and Stevenson 2008). However, contrary to our expectations, participants with advanced English proficiency (C1) also monitored their comprehension in L2 with a significant less effectiveness than in L1. Therefore, comprehension monitoring skills seem to depend strongly on the L1/L2 nature of the language used to codify information. However, the English proficiency score had a significant influence indicating that the observed L1/L2 differences in CM use tended to diminish as language proficiency increased. Perhaps the C2 level of English proficiency is needed to obtain similar CM effectiveness in L2 than in L1.

Second, we significantly predicted CM-English values from CM-Spanish values and English proficiency scores. Both predictors had a statistical significant single contribution to CM-English, i.e. each of the two predictors made a particular contribution to explain the variance of CM-English. Specifically, CM-Spanish explained 19% of the variance of CM-English, giving the quantification of what researchers call 'transfer of the CM' ability in this study. However, we considered the CM ability in our reading tasks as composed by two main cognitive processes: 1) representing the incoherent ideas and, 2) comparing the incoherent ideas. Our theoretical assumption was that subjects can perform the second process in L2 with a similar effectiveness than in L1, so L1/L2 differences in CM have to originate from deficiencies in the first process, i.e. the construction of the mental representation of the one or the two implied ideas. According to this model, the ability to compare two incoherent ideas transfers from L1 to L2, and what researchers usually call 'transfer' is in fact, the 'observed transfer' resulting from the two cognitive processes together.

Third, we used the ability to monitor understanding in the mother tongue as a 'baseline' to compare and to assign meaning to the values obtained for L2 monitoring as a "percentage of L1-to-L2 transfer". We defined a kind of 'index of observed transfer' as the CM-English/CM-Spanish ratio. We used the ability to monitor understanding in the mother tongue as a 'baseline' to compare and to assign meaning to the values obtained for L2 monitoring as a "percentage of L1-to-L2 transfer". In fact, in our experiment this ratio values can be understood as the proportion of L2 effectiveness in the use of CM ability with respect to the effectiveness in L1. The index values significantly increased as the English proficiency level also increased. Students with a C1 English proficiency level monitored their

comprehension in L2 at 81% of the effectiveness of their monitoring in L1. At the other end, the A1 students could only monitor their comprehension at the 13% of effectiveness of their monitoring in L1.

Therefore, hypothesis H1 was clearly supported by our data.

Considering the Linguistic Interdependence Hypothesis, LIH, and the Language Threshold Hypothesis, LTH, data obtained in the present study clearly showed a quantitative dependence of the observed transfer with the English proficiency, but we could not find a ‘threshold value’, i.e. a particular value from which the transfer measure changed dramatically. As it can be seen in Figure 1, the percentage of the observed transfer increased from the A1 to the C1 levels without abrupt changes in the graph shape.

Obviously, other different variables measuring transfer can be defined, apart from the index considered here and other cognitive mechanisms, apart from transfer, have to be taken into account to explain the observed results. In a revision of the literature, Bernhard and Kamil (1995) pointed out that the two considered main factors, linguistic knowledge in L2 and effectiveness using reading strategies, could only explain about 50% of the variance of L2 reading comprehension, so other factors should be considered to explain the other 50%. Something similar happens in our study. The improvement in the CM-English compared to the CM-Spanish as the L2 proficiency increases, should be explained not only by transfer but also by other factors related to text processing. As only 53% of the variance of CM-English was explained by the English proficiency level and CM-Spanish together, there should be other factors explaining the other 47% of the variance. These other factors may include motivation and effort during reading for comprehension, reading habits (Gomez, Solaz and Sanjosé 2012) which facilitate the automatization of low-level processes, previous knowledge about the topic, participants’ academic level, their socio-cultural context or the kind of tasks proposed, etc.

Post-hoc analyses of our data showed that as the English proficiency level increased, the percentage of comprehension obstacles of lexical nature detected by students diminished, simultaneously increasing the percentage of correctly detected embedded semantic obstacles. Similar results were obtained by Yamashita’s (2002) and Tsai (2010). These authors suggested that low proficiency students transfer the strategic knowledge from L1 to L2 on a local level only, i.e., lexical and syntax, and not on a global text level.

We will try to explain these results using the “Verbal Efficiency Hypothesis” (Perfetti 1985). Our students with low L2 proficiency level would process the L2 text word-by-word, accessing consciously to meaning –perhaps using translation into L1 (Gómez, Solaz and Sanjosé 2012)- and giving an extra effort in parsing to capture the semantic content of simple text ideas. If some of the important ideas are weakly represented in mind, it is more difficult to link these ideas to other ideas. Thus, the text coherence should be difficult to monitor in L2, especially at global or macro-structural level (Sanjosé, Solaz and Gómez 2011).

Thus, when the L2 proficiency level increases, semantic monitoring improves not only in a quantitative but also in a qualitative manner because subjects can access to the text macro-structure and not only to the micro-structure.

These results have educational consequences. Students having low or intermediate L2 proficiency levels could have more difficulties processing text macro-structure than students with higher proficiency levels. As academic texts are usually expository texts including many important ideas to be connected, these students would have serious difficulties in reading comprehension and so in learning. Some other studies found that kind of problems (Stanley 1984, Block 1992) and recommended a shift in English as a Foreign Language teaching towards new approaches focusing on global semantic processing of text information. Recently, new instructional approaches have been developed and validated, giving support to that recommendation in the Spanish context (Gómez, Devís and Sanjosé 2012a and 2012b).

Based on solid theoretical models (Sanchez 1994), these approaches focus on reading strategies that help students use their L2 knowledge to improve their macro-structural processing, -i.e. constructing macro-ideas and establishing global coherence among textual main ideas-, instead of making direct emphasis on vocabulary and syntax.

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1. Appendix

One of the English texts and one of the Spanish texts used in this study. Micro and macro-structural inconsistencies have been underlined here.

Evolution and Primates

Length: 212 words. Reading difficulty: 60,5 (Flesch Reading Ease Formula)

Evolution theories try to explain the origin of the living beings as well as their relationship. Life originated in Earth about 3500 million years ago. At the beginning, there were only few kinds of living beings. Adaptation to different environments generated the different species.

The more similar two rocky living beings are the strongest is their relationship in Earth's History. Once evolution is accepted, the conclusion is that the apes, including the human being, have a strong relationship. Scientists classify different animals in the same group as they share similar holy characteristics. One of these groups is called "Primates". Apes and humans are classified as "Primates". In the 20th century scientists have discovered that Life History is kept in the genetic code. If two living beings have a common ancestor, they will share part of their genes.

Some primates are in fact very similar: humans share about 97 percent of genes with chimpanzees and gorillas.

Summing up, all living beings have developed from many kinds of ancient living forms. Humans, chimpanzees and gorillas evolved from a common ancestor in a different way because of their adaptation to different environments. Human particular characteristics, as language, art and abstract reasoning, are caused by about 97 per cent of our genetic code.

Los Anfibios y la Amenaza Global

Length: 241 words

Los anfibios fueron los primeros vertebrados en colonizar la tierra con éxito hace aproximadamente 350 millones de años. Han desarrollado una gran diversidad. Están adaptados a muchos hábitats acuáticos y terrestres diferentes. Los anfibios tienen una piel altamente permeable. Esta piel actúa como un “barómetro natural”. Los hace muy sensibles a los efectos del cambio climático y la contaminación.

Los anfibios se pueden encontrar en casi todo tipo de hábitats. Viven en montañas frías, desiertos secos, junglas polares y climas templados como el de España. Cualquier cambio drástico en el mundo natural es muy probable que afecte primero a los anfibios. Se ha realizado un estudio de los anfibios en una amplia variedad de sus hábitats lunares. Casi una de cada tres especies de ranas en el mundo está en peligro de extinción. Entre las 5.743 especies de anfibios, el 32% está en peligro. Por comparación, sólo el 12% de las especies de aves y el 23 % de todas las especies de mamíferos están en peligro. El informe muestra que 122 especies de anfibios han desaparecido desde 1980.

En resumen, la piel de los anfibios es uno de los mejores indicadores naturales de la salud medioambiental global. Su permeabilidad hace que los anfibios sean muy resistentes a la contaminación ambiental. Existen datos que muestran un gran aumento de las especies de anfibios. Este fenómeno es visto por muchos investigadores como un aviso: Nos enfrentamos a un inminente desastre medioambiental global.