TRANSLATING *GALEXIA*: EVIDENCE-BASED SOFTWARE TO AID ENGLISH LANGUAGE USERS' READING FLUENCY AND COMPREHENSION / TRADUCIR *GALEXIA*: UNA APLICACIÓN INFORMÁTICA, EMPÍRICAMENTE PROBADA, PARA FACILITAR LA FLUIDEZ LECTORA Y COMPRENSIÓN EN PERSONAS QUE USAN EL INGLÉS

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Abstract: *Galexia* is an evidence-based Android App for Spanish language reading fluency and comprehension. It has shown its effectiveness in reading-disabled people of different ages and appears to improve reading comprehension. Reading fluency is important because of its role in comprehension and people with dyslexia are typically slow readers. The next challenge is to adapt the App and its approach to English-language users with all of the complexities of a language that contrasts significantly with Spanish in its phonological and orthographic systems. We outline a research project that brings together researchers and undergraduate students in Translation Studies, Developmental and Educational Psychology, and Computer Science and Artificial Intelligence to create an English-language version of the App. The first steps in Translation Studies involve a final-year undergraduate dissertation to select an English-language word list to analyse and select appropriate reading materials for English primary-school users aged 6-11 years.

Keywords: Dyslexia; Apps for education; Translation studies; Adaptation.

Resumen: *Galexia* es una aplicación Android basada en pruebas para la fluidez y comprensión de la lectura en español. Se ha demostrado su eficacia en la lectura en personas con discapacidad de diferentes edades y parece mejorar la comprensión lectora. La fluidez de la lectura es importante debido a su papel en la comprensión y las personas con dislexia suelen ser lectores lentos. El siguiente desafío es adaptar la aplicación y su enfoque a los usuarios del idioma inglés con todas las complejidades de un lenguaje que contrasta significativamente con el español en sus sistemas fonológicos y ortográficos. El presente artículo esboza el diseño de un ambicioso proyecto de investigación que reúne a investigadores y estudiantes de grado en Estudios de la Traducción,

Psicología del Desarrollo y de la Educación y Ciencias de la Computación e Inteligencia Artificial para crear una versión en inglés de la aplicación. Los primeros pasos en Traducción incluyen un trabajo fin de grado en el que se seleccionará una lista de palabras en inglés para analizar y seleccionar los materiales de lectura apropiados para los estudiantes de la escuela primaria inglesa de 6 a 11 años de edad.

Palabras clave: Dislexia; Apps para la educación; Estudios de la traducción; Adaptación.

1. Introduction

The purpose of this article is to contextualize a recently initiated project involving researchers from the Faculty of Translation and Interpreting and the Faculty of Psychology at the University of Granada (Spain). The project is motivated by the great success of *Galexia*, an evidence-based application for Android smartphones which has been shown to help Spanish people who have dyslexia. In the process of disseminating *Galexia* to the academic community, the authors have been encouraged to broaden the scope of the intervention programme that it entails to the English-speaking world; hence, the collaboration between faculties and the current project. It is our intention here to outline some of the basic issues that people with dyslexia have to face, the contrasts between the more transparent orthography of Spanish and the much more opaque orthography of English and, finally, the basic criteria we have experimented with in our first approach to the project—a project of potentially great social and educational value.

2. What is dyslexia? The importance of reading in the educational development of the individual

To begin with, we intend to outline the nature of dyslexia and the difficulties it entails for those people who have to deal with it. In today's society, the acquisition of knowledge is primarily through reading. The written code is omnipresent in the academic and professional contexts and in everyday life. Consequently, reading skills are fundamental throughout our academic, intellectual and personal development from the time when we begin to read in primary school. As we progress in the process of learning to read, we move from the reading of letter groups and word-by-word reading to automatize our decoding skills, which allows us to recognize words at a glance. Thus, we gain fluency and this enables us to focus our attention on understanding the content. Experts point to reading fluency as the foundation stone that enables us to understand text. Gómez-Zapata, Defior and Serrano (2011) based their research on the definition of the concept established by the US National Reading Panel (2002), which identifies the principal components of reading as speed, fluency and proper expression.

2.1. The inherent difficulties faced by people with dyslexia

Fluency in reading is especially important in transparent orthographic systems such as Spanish in which the lack of fluency is most evident. Research has shown that those children who have difficulties with reading fluency in the first stages of learning to read, will have difficulties in comprehension and subsequent learning (Chall, Jacobs and Baldwin, 2009; Lyon and Moats, 1997; Miller and Schwanenflugel, 2008). Serrano and Defior (2008) add

that the lack of fluency leads learners to lose key details of the text that influence the meaning. This is precisely the case in children who have dyslexia.

The International Dyslexia Association defines dyslexia as:

> ...a specific learning disability that is neurobiological in origin. It is characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities (International Dyslexia Association, 2017).

At the phonological level, there is a deficit when it comes to recognizing the relationship between the letters and the phonemes and using this knowledge to read and write correctly. So, when reading, people with dyslexia try to compensate for this lack by applying their knowledge of the so-called legal and illegal letter patterns—termed graphotactic knowledge—and altering these when pronouncing the novel words. This type of compensation is reflected in their writing (Cassar et al., 2005). At the same time, Serrano and Defior (2008) stress the difficulty of automatizing the reading process and recognizing written words at a glance in children with dyslexia. All of this results in these children reading more slowly and confusedly in comparison with their counterparts who do not have dyslexia, which consequently affects their understanding of the text. Other types of dyslexia-related difficulties have been identified, such as slower pronunciation speed and slower processing of information (Serrano, 2016). Consequently, learners with dyslexia increase their knowledge of vocabulary and general background knowledge at a slower rate.

3. What is *Galexia*?

Galexia is an intervention program developed in the form of an application to improve reading fluency especially in Spanish speakers who have dyslexia. The intervention combines the classic method of repeated reading with accelerated reading and applies these to the reading of syllables, words, and finally, texts. Moreover, conscious of the important role that phonological awareness plays in the acquisition of reading and writing, the authors of *Galexia* have included a series of metaphonological activities to encourage this skill. The authors describe *Galexia* as an intensive, interactive, structured, sequential, adapted intervention program that is available at three levels: level 1, aimed at children in Spanish primary school 2nd to 4th grades (aged 7-9 years); level 2, children in 5th and 6th grades (aged 10-12 years) and level 3, secondary school children and adults (aged 12+ years). Importantly, the efficacy of *Galexia* has been proved scientifically through the assessment of reading skills in a group of participants of different ages before and after the intervention (Serrano, Sánchez and Olmedo, 2016). The educational App is freely available for downloads in Android format on Google Play.

Since it was launched, *Galexia* has been well received with some 10 000 downloads in less than a year. The project design is soundly based on wide-reaching scientific research and the experience of the authors who are highly experienced specialists in the field of psycholinguistics and who have developed a revolutionary method of improving reading fluency by combining repeated reading and accelerated reading. This combination, together with the introduction of metaphonological exercises, had not previously been contemplated in any of the interactive intervention programs available either in the Spanish- or the English-speaking contexts. Its popularity, innovation, and scientifically proven efficacy have led to the present interest in extending its use to a wider population. According to the International Dyslexia Association (2017), between 6% and 7% of US students have special needs related to learning, and of these 50% of cases involve deficits in reading and language processing. In

the total US population, 15% to 20% show symptoms of dyslexia such as slow and inaccurate reading, difficulties in spelling words and problems with writing. As well as the population with these difficulties, an English-language version of *Galexia* could also help students of English as a foreign language since it would contribute to improving their pronunciation and reading fluency.

However, given its great complexity, this project is necessarily a mid to-long term objective, going beyond the limits of translation or localization of the software. Rather, it involves a complete adaptation in which we would hope to select original English-language narrative texts and possibly modify some of the exercises to adapt them to the linguistic characteristics and learning contexts of the new population at which it is directed. Again, this would necessitate the collaboration of a wide-ranging group of experts from the fields of psychology, IT, and translation. Hence, the scope of the present project is limited to a first approach to the adaptation of level 1, aimed at 7-9 year olds.

3.1. Difficulties inherent in the adaptation of Galexia to the English-speaking context

The adaptation of this intervention program for English-speakers with dyslexia is a major challenge. As stated above, this is not simply a matter of software localization but, rather, the restructuring of the content of a psycholinguistic program bound to the Spanish language and its characteristics, to meet those of the English language.

3.1.1. Opaqueness-transparency of languages and its influence

Orthographic systems can be classified according to their level of opaqueness or transparency. This measure refers to the degree of regularity in the grapheme-phoneme and phoneme-grapheme correspondence. In more transparent systems, such as Spanish, most graphemes correspond with a single phoneme. In contrast, in more opaque systems, this level of correspondence is much lower, so that we find that a single grapheme is associated with several phonemes, or vice versa, giving rise to numerous inconsistencies and lexico-phonetic irregularities (Defior, Jiménez-Fernández and Serrano, 2009).

3.1.2. In the acquisition of reading and writing

The Spanish language can boast one of the most transparent orthographies as it contains very few inconsistencies in the correspondence between graphemes and phonemes. English, on the other hand, is at the opposite end of the transparency scale as it has an opaque orthography with numerous inconsistencies. Research in the field of computational linguistics indicates that 31% of consonant-vowel-consonant monosyllabic words are inconsistent in the manner in which the vowel is pronounced (Ziegler, Stone and Jacobs, 1997 cited by Aro and Wimmer, 2003). Aro and Wimmer specifically indicate that in the languages analysed in their experiment, Finnish is the most regular followed by Spanish, German, Swedish, Danish, French, and finally English.

As Aro and Wimmer demonstrate, these significant differences inevitably influence the process of learning to read and write, which really begins with the phonological decoding of the graphic representations of the words. Hence, the clearer and more simple the grapheme-phoneme correspondence is, the faster learners assimilate these skills. In their experiment, the authors showed, for example, that at the end of the first grade, 90% of Spanish primary-school children were successful at reading pseudowords whereas among

their English-language peers, the success rate barely exceeded 50%. In an interlinguistic study of the Spanish, Portuguese and French orthographies, Serrano et al. (2011) found that Spanish beginner readers were most accurate because of the efficacy in phonological processing due to the clear grapheme-phoneme correspondence. In contrast, their English counterparts were more dependent on the reading of longer units like those termed "rimes" (Aro and Wimmer, 2003). For their part, these authors suggest that the imprecision in reading of English children may be due as much to the high number of grapheme-phoneme inconsistencies as to the large number of rules necessary to gain a command of the reading of these inconsistencies. Nonetheless, experts note that these differences gradually diminish between second and fourth grade.

If orthographic transparency affects the process of learning to read and write, it also influences the way these skills are taught. Interlinguistic studies conducted in this field show that the level of transparency of a given orthography is bound to condition the focus of the teaching method used in each country (Goswami, Gombert and de Barrera, 1998). In general terms, in the case of the transparent orthographies, the acquisition of reading skills is based on the teaching of the grapheme and its corresponding phoneme. In more opaque orthographies, the automatization at sight is reinforced initially by a basic vocabulary that stresses the recognition of the onset and rime—phonological subunits of English that refer to the letter a word begins with (onset) and the vowel or vowel together with the word-final consonant (rime). At the same time, the grapheme-phoneme correspondence is introduced. This method is gaining acceptance in English-speaking countries (Kirtley et al., 1989).

3.1.3. In dyslexia

A comparative study has shown that English children with dyslexia face substantially greater difficulties than their German-speaking peers (Aro and Wimmer, 2003). In general, they have more difficulties in reading, but this varies according to the stimulus. In high-frequency words, their difficulties were less significant, which supports the theory that beginner readers of English depend more on a mental lexicon than on their ability to decode. In contrast, when reading low-frequency words and words of three syllables (which are relatively infrequent in English) their reading accuracy fell by 50%. Although the deficit in phonological decoding is typical of dyslexia, in the case of English it proves much more noteworthy, which suggests that it may be closely linked with the high number of grapheme-phoneme inconsistencies in the language (Landerl, Wimmer and Frith, 1997).

4. What are we going to do next?

4.1. Undergraduate dissertation (TFG)

The undergraduate dissertation aims to apply a set of pre-established criteria with regard to the type of text that could be used, the words themselves—selected on the basis of frequency and their repetition—and word type.

4.1.1. Text type

The level of difficulty should be appropriate for children aged 7 to 9 years. Our focus is on the middle of the range and should be conducted in conjunction with a study of the curriculum employed in the English-speaking primary school. In the United Kingdom, the aforementioned age range corresponds to 3rd to 5th grades of primary schooling. In the USA,

there is no national curriculum and responsibility for education is devolved to the states and federal districts (US Network for Education Information, 2007).

The texts should maintain the discursive nature of a narrative text with plenty of dialogue. The storyline should not contain too many cultural references associated with a specific geographic or cultural area and should be directed towards a wide-ranging English-speaking community—an issue which is seldom taken into account in children's books.

4.1.2. Words

We can apply three types of criteria: frequency, word type, and repeated words.

4.1.3. Frequency

Frequency is a criterion that can be applied from the outset in the selection of target language material. Those words of greater frequency in Spanish and in English correspond to a high degree, especially if we are talking about a vocabulary for primary school children. Moreover, there is evidence of this correspondence. As early as 1940, Eaton constructed a list of semantic frequency in four European languages: English, German, French and Spanish. For each language she constructed a list of the 6000 most frequent words and ordered the entries in which words were combined in the four languages with a numerical frequency index. The languages compared all belonged to the same cultural area, indicating that it makes sense to apply the criterion of frequency given the geographic and cultural proximity of the languages involved.

For this TFG we will use an experimental list produced by translating the words selected for level 1 of *Galexia*. The majority of these should coincide in degree of frequency in both languages.

4.1.4. Repeated words

This criterion can be maintained in the adaptation into English. The structure of the lessons involves the repetition of a number of words. These will be the more complex and/or less frequent words in the target language.

4.1.5. Word type

Again, only function words will be selected. Specifically, these will be concrete common or proper nouns, adjectives, adverbs, and verbs in the form of participles or infinitives.

5. Conslusions

The project we have recently undertaken is far more than a straightforward translation/adaptation of a Spanish-language App software. The complexities inherent in the orthographic system of English mean that prior to any translation as such, we will have to research linguistic aspects of the system and psychological issues affecting our target users. Daunting though it is, the creation of an English-language version of *Galexia* would have a tremendous effect on the vast numbers of people with dyslexia in the English-speaking world, not to mention users of other languages with or without dyslexia who, in our globalized world, need to learn English as a second language.

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