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Research Paper

Cross-Lingual Analysis of Pseudo-homophone Recognition in Language Learners: Phonological Evidence for Word Recognition

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Abstract

This study aimed to examine the cross-lingual recognition of French and English words and their pseudo-homophones to verify the presence of Grapheme-Phoneme Conversion (GPC) for the word recognition of foreign language learners. The participants' homogeneity and proficiency level were checked with the aid of an English proficiency test (McMillan Placement Test (MPT)) and a French proficiency test (Test d'Évaluation de Français (TEF)) before the examination phase. To investigate the participants' reaction times for recognizing the real words, illegal nonwords, and legal nonwords (pseudo-homophones), a computerized test was designed that sought the participants' judgments about the presented linguistic construct on the screen. The employed words were chosen according to their morphological complexity, frequency, and length from the learners' course books. Data analysis revealed that pseudo-homophones were more challenging for both English and French learners to recognize; this was shown by their higher reaction time needed for recognizing pseudo-homophones compared with the real words and the illegal nonwords. Although the occurrence of GPC for both groups was attested, it was significantly stronger for the French learners. These findings suggest that word recognition is inherently a phonological process (not an orthographic one) among foreign language learners.

Keywords: Reaction-time, Pseudo-homophones, Word Recognition, Grapheme-phoneme Conversion (GPC)

Word processing and recognition in reading have been the key factor throughout the history of EFL/EFL studies (Pugh et al., 2005). Spivey et al. (2012) claimed that word recognition research has been central to work in cognitive psychology and psycholinguistics because words are minimal units that carry many analysis codes (i.e., orthography, phonology, semantics, syntax). Visual input is not recognized directly by letter-by-letter,

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leading to the notion of word superiority effect (Rastle, 2013). The word superiority effect suggests that one can recognize letters more rapidly when they occur in words rather than nonwords (Warren, 2013). Warren further classified nonwords into illegal and legal categories; "illegal nonwords" refers to sequences of letters or characters that do not form valid words in a particular language or linguistic context. These combinations may violate the language's phonological rules, spelling conventions, or linguistic structure. However, "legal nonwords" are those strings of letters that are legitimate sequences but do not make a word. The legal nonwords (usually known as pseudo-homophones) are phonetically similar to real words but differ in their orthographic representation. These linguistic constructs share a similar pronunciation with genuine words but are deliberately spelled in a way that deviates from the standard spelling of the corresponding real words; this makes the psycholinguists capable of investigating the basis of word recognition in mind.

On the topic of visual word recognition, Warren (2013) referred to one of the most widely known theories on reading and comprehending words which is called the grapheme-phoneme conversion (GPC); there is a rule-based system that converts written strings into forms for pronunciation. There are different views toward this theory; on the extreme, it is believed that GPC happens obligatorily, and learners' minds are just capable of matching the word in the lexicon once there is a recognition of the word's pronunciation. There are also less extreme proposals in which subvocalization is not viewed as a mandatory process but still maintains the existence of the relationship between orthography and phonology, even if silent reading is in progress.

Considering the salience of recognizing words of foreign languages for the learners and the necessity of recognizing words for comprehending the texts, this study has examined the difference in the reaction time of words, legal and illegal nonwords' recognition for the advanced foreign language learners of English and French. If pseudo-homophones were found to be the most challenging to comprehend, that would be empirical evidence for the occurrence of grapheme-phoneme conversion (GPC) for foreign language learners and the phonological basis of word recognition even for the advanced learners since, for recognizing the pseudo-homophones, readers may confront an acceptable phonological unit accompanying with an incorrect orthography; this discrepancy would lead to an extra cognitive challenge for recognizing pseudo-homophones which would result in a longer reaction-time in judgment tasks. Moreover, considering the advanced learners of two languages as the study's participants, the occurrence of GPC for recognition can be judged from a cross-linguistic point of view. Therefore, the following research questions are formed based on the research objectives:

1. Is recognizing pseudo-homophones significantly more challenging than recognizing real words and illegal nonwords for advanced foreign language learners?

2. Does GPC happen for both English and French advanced language learners during the

word recognition tasks?

3. Is there any significant difference between advanced English and French language learners in recognizing the pseudo-homophones?

Literature Review

Visual word recognition

Visual word recognition is a fundamental aspect of language learning, representing the ability to understand and make sense of individual words within a given linguistic context (Spieler et al., 2016). Visual word recognition is the process of identifying printed letter strings as a unique word, and its meaning and other dimensions are computed. This process is inherently context-dependent and holds particular relevance for foreign language learners. Contextual cues, whether derived from surrounding words, situational factors, or cultural references, play a crucial role in deciphering the meaning of unfamiliar words (Nation, 2003). Similarly, Rastle (2013) claimed that a skilled reader is one who can immediately link a word to its associated sound and meaning.

Visual word recognition is an integral aspect of reading proficiency. Although readers are able to recognize visually presented words with apparent ease, the processes that map orthography to phonology and semantics are far from straightforward (New et al., 2006; Yap & Balota, 2015). In one of the earliest studies of visual word recognition, Cattel (1886) claimed that learners recognize words on the basis of their shapes; however, the more recent studies on the same topic made theoreticians unanimously believe that words are recognized in a hierarchical manner based on their constituents (e.g., Perry et al., 2007). The neural/mental operations involved in the process of visual word recognition are fundamental for the efficient comprehension of written/printed words during the reading tasks (Spieler et al., 2016).

Pseudo-homophones and their importance

The intricate interplay between pronunciation and spelling in language poses unique challenges for cognitive processing. Among the various linguistic phenomena, pseudo-homophones stand out as words that share similar phonetic features but are orthographically distinct. Pseudo-homophones are important stimuli because they allow researchers to study the influence of phonology in accessing the meaning. Cognitive models of language processing posit that encountering pseudo-homophones triggers a conflict between phonological similarity and orthographic dissimilarity; this ambiguity can affect various cognitive processes and finally leads to an increased processing time and comprehension challenge (Dijkstra & Van Heuven, 2002; Larionova et al., 2024).

Indeed, focusing on the quality of pseudo-homophones' mental processing, valuable insights would be provided regarding the amount and the nature of the extra cognitive burden pseudo-homophones impose to be recognized. This occurs by determining the fact that which aspect of the lexical items (orthographic or phonologic representations) plays a more

fundamental role in their recognition. The finding can be considered as a general mental mechanism for recognizing real words.

Measuring the recognition of pseudo-homophones

From assessing language acquisition and phonological awareness to exploring lexical processing and cognitive neuroscience, nonwords in general and pseudo-homophones in particular serve as psycholinguistic versatile tools in experimental studies. The findings may contribute to theoretical models of language processing and practical applications in assessing and addressing language-related challenges, particularly in the context of literacy development, language disorders, and L2 language development.

Eye-tracking studies have widely investigated the recognition of pseudo-homophones during reading tasks. For instance, research by Rayner (1998) revealed longer fixation times and higher regression rates when participants encountered pseudo-homophones, indicative of the additional cognitive effort required for disambiguation. Larionova and Garakh (2024) also documented that pseudo-homophones activate the semantic networks more or less in the same way; this activation happens by the real words. Jiang and Pae (2020) also explored the recognition of pseudo-homophones in L2 reading tasks and revealed a strong pseudo-homophone effect (delayed judgment and recognition) for both the native and the non-native participants; this implies that pseudo-homophones are challenging words that activate the real words' cognitive representations either semantically or phonologically.

Neuro-imaging studies have also contributed to understanding the neural mechanisms underlying pseudo-homophones' processing. Functional magnetic resonance imaging (fMRI) studies (Binder et al., 2005) and event-related potentials (ERPs) (Holcomb & Grainger, 2006; Larionova & Garakh, 2024) have identified brain regions and temporal dynamics associated with the recognition and resolution of pseudo-homophones. Nonwords (including both legal and illegal) play a multifaceted and critical role in advancing the understanding of language processing across various domains.

Word recognition models

Different models have been proposed in relation to the cognitive mechanisms of word processing; some of them emphasize the interaction of different words' representations for recognition and are called *Connectionist models* in general. For example, in the *hierarchical* model of word processing, the information that the reader's mind receives from the written stimuli would be connected to their stored orthographic, semantic representations before the recognition (Plaut et al., 1996). Another connectionist model proposes that the received information is first activated in higher-level representations at words' rhymes, morphemes, and syllables before the whole word is activated in a reader's mind (e.g., Carreiras & Perea, 2002). Similarly, the *bidirectional* model of word recognition suggests that the information flows in a bidirectional matter across the connections in the way that letters activate words' orthographic representations, and words' orthography activates phonologic representations (Rastle, 2013).

A quite different model of word recognition, labeled as the *Dual route model* (Coltheart et al., 1993), argues in favor of pseudo-homophones' advantage over illegal nonwords when it comes to reading words. In a *Dual Route* approach, stimuli are processed alongside a lexical or assembly route which means that a word's letters are translated into their phonological code, a process known as grapheme to phoneme conversion (GPC). GPC investigates the presence of a pathway through which learners convert written strings into pronunciation forms in a rule-based system. Studies show that learners can read legal nonwords faster than illegal ones and that is because of the GPC rules, as learners have, through time, created an element of sub-word translation that takes them from spelling to pronunciation.

On the other hand, the Connectionist model posits that all the mental representations of the lexical items, including phonologic, orthographic and semantic aspects, are interconnected in neural networks with different degrees of strength based on the items' frequency of exposure. During the recognition process of a word, no activation priority can be considered for any of the words' representations due to their network-based interconnection (Rueckl, 2010).

Understanding how GPC skills develop can be crucial for insights into literacy acquisition. Research on developmental dyslexia has highlighted the role of difficulties in grapheme-phoneme mapping as a contributing factor (Amenta & Crepaldi, 2012). Longitudinal studies have also explored the developmental trajectory of GPC skills, shedding light on the milestones and challenges faced by young readers (Ehri, 2014). Insights from research on GPC have direct implications for literacy instruction; effective teaching strategies, interventions, and assessments often incorporate knowledge about the cognitive processes involved in accurate and efficient grapheme-phoneme mapping (Snowling & Hulme, 2006). However, to date, very few studies have shown whether the same thing is true for the recognition of words and their pseudo-homophones among adult advanced foreign language learners.

Word recognition by EFL learners

Foreign language learners face various challenges in word recognition, ranging from lexical ambiguity to cultural nuances (Nation, 2003). Ambiguity arises when a word has multiple meanings, requiring learners to discern the appropriate interpretation based on context (Damian & Bowers, 2003). Cultural differences contribute to challenges in understanding idiomatic expressions and culturally embedded vocabulary (Kasper & Blum-Kulka, 1993). To address these challenges, proficient learners might employ context analysis, infer meaning from related words, and seek clarification through language resources or native speakers.

Although many studies have been conducted on word recognition and comparing words and nonwords (legal or illegal), no similar study is administered in the Iranian foreign language learning context. Moreover, former studies on words and pseudo-homophones have had inconsistent results, and most of them have been conducted on native speakers,

particularly for clinical purposes. The practical implications of pseudo-homophones' recognition can extend across diverse fields of study. In language education, for example, these implications may inform the development of materials and interventions aimed at enhancing phonological and orthographic skills in learners (Khaghaninejad et al., 2016; Larionova et al., 2023; Shojayee et al., 2018; Ziegler & Goswami, 2005). Additionally, within natural language processing, an understanding of pseudo-homophones' comprehension would contribute to the development of language technologies that can serve curriculum and material developers (Ferreira, 2003).

Method

Participants

As the initial pool, 140 advanced Iranian EFL and FFL learners who spoke Persian as their first language were chosen through a non-random convenience sampling technique from the undergraduates of Shiraz University's foreign languages department. Firstly, the proficiency levels of the participants were assessed using the McMillan Placement Test (MPT) for EFL students and d'Évaluation de Français (TEF) for the FFL learners. Subsequently, 100 advanced English and French learners were selected and recruited for the study. The participants were from both genders (28 female and 22 male English learners and 34 female and 16 male French learners), and their ages ranged from 18 to 31 years. Before the study's commencement, the consent of the participants were sought, and they were assured that their performance would kept confidential.

Instruments and materials

In formulating this study, three assessments were carried out:

- The *McMillan Placement Test (MPT)* was administered to ascertain the proficiency levels of English learners. This test is designed to categorize proficiency levels, spanning from complete beginners to advanced learners. This test is available in British and American English and consists of three parts: Grammar, vocabulary, and reading. It is designed to place learners at a level ranging from elementary to advanced based on their performance. The scoring range in MPT is from 0 to 50, and according to the test's criteria, participants with scores exceeding 45 are deemed advanced English learners. The acceptable reliability (92%) of the test which is a universally-accepted and employed English placement test, is reported by Macmillan straight forward (2022). Moreover, the validity of the test was approved by a group of experts in TEFL at Shiraz University.
- The *Test d'Évaluation de Français (TEF)* as a standardized French language proficiency test was also employed to homogenize the advanced French learners. It assesses reading, writing, listening, and speaking skills and offers multiple levels of certification. The TEF which is administered by the French Ministry of Education and enjoys satisfactory reliability values (FIAF, 2022) is universally recognized by many universities, colleges, and employers as a reliable measure of French language proficiency. The TEF is divided

into four sections: compréhension écrite (reading comprehension), compréhension orale (listening comprehension), expression écrite (written expression) and expression orale (oral expression). Each section of the TEF is scored on a scale of 0 to 20, with a total score of 60 to 160. The TEF also offers a score on a scale of A1 to C2, which corresponds to the Common European Framework of Reference for Languages (CEFR).

- *Word Recognition test (WORT)* as a computerized test was designed according to the needs and objectives of the study; through a lexical decision task (LDT), the reaction time of the participants' judgments about the real words, the illegal nonwords, and pseudo-homophones was measured. The English test included 60 items for which 60 words were chosen considering their frequency and length from their academic course books. The test included 25 real words, 25 pseudo-homophones, and 10 illegal nonwords. The time limit for the test was 15 minutes, allowing students to spend a maximum of 15 seconds for each question. If the participants were not able to decide about the type of the provided letter strings on the screen (i.e., real words, nonwords, and pseudo-homophones) in the allocated time limit, automatically, the next item would be presented on the screen, and the maximum time (i.e., 15 seconds) was considered for the undecided item. The French learners went through the same procedure. Similar to English learners, a maximum time of 15 seconds for answering each item was allocated, and participants were given 15 minutes to complete the test. The test was exclusively created for the purpose of this study and was supervised throughout the process. The participants were provided with a string of letters (between 7 to 10 letters for both groups) on the center of the screen and were asked to select one of the provided options of "real word," "illegal nonword," and "pseudo-homophones" at the bottom of the screen while a count-down timer was observable on the top of the screen. The test provides the exact reaction time needed for each item for each participant at the end of the test in a table. Before administering the test, it was piloted for both the French and English versions, and some minor revisions were accommodated.

Data collection procedure

After gaining certitude about the participants' levels of proficiency via the English and the French proficiency tests, the participants' recognition of real words, illegal nonwords, and pseudo-homophones was evaluated based on their reaction time in a lexical decision task; 60 English and 60 French items were constructed from which 25 items were real words, 25 items were pseudo-homophones, and 10 were illegal nonwords. The participants were able to see a list of possible answers and were asked to click on the right one within a 15-second time limit.

In order to select the words for the test, different variables such as morphological structure, frequency and length of the words were taken into account; the words were chosen from the participants' academic course books (i.e., *Cambridge C1 and C2 course books* for the English learners (Hawkey & Milanovic, 2013). and *Edito*, (Pinson, 2019) for the French learners) which have used new words according to the corpus of language based on word

frequency for advanced users. Therefore, the test items were devoid of words with a low frequency of usage. Regarding part of speech, only adjectives and nouns were selected for this study, and selected words were all from 2 syllables to 3 syllables, including 7 to 10 letters. The illegal nonwords were fabricated with the same format to homogenize the test. The following table depicts an example of the items used for each group. Figure 1 also manifests an example of the constructed items for the English and French participants in WORT.

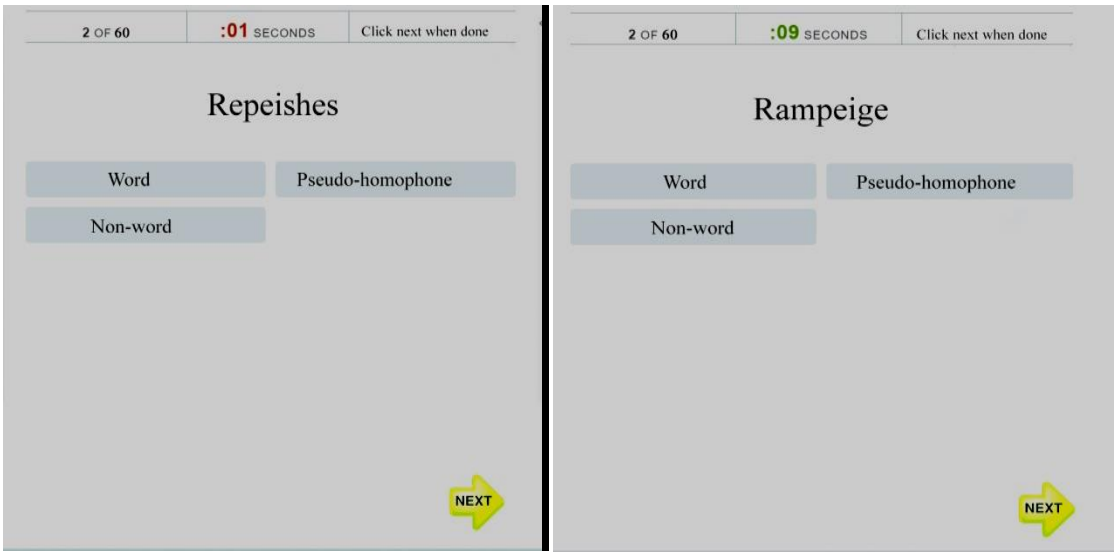
Table 1

Examples of the items used for the English and French learners

	Real word	Pseudo-homophone	Illegal nonword
English items	Rapacious	rapeishes	rptaishus
French items	Heureuse	Houreuse	Hreouse

Figure 1

Examples of constructed items for the English and French participants in WORT



Data analysis procedure

Based on the time spent for the participants to judge each presented item (their reaction-time), the occurrence of GPC for recognizing the words was evaluated. Statistically significant differences in the participants" reaction times for judging the three types of items presented on the screen would certify the happening of GPC for the recognizing tasks. Different parametric statistical analyses, including independent-sample t-tests and ANOVA, were utilized to explore potential distinctions among participants' comprehension of real words, illegal nonwords, and pseudo-homophones.

Results

According to the research objectives and questions, both descriptive and inferential statistical analysis techniques were employed to compare the recognition of real words, nonwords, and pseudo-homophones by advanced English and French learners.

Do advanced English and French learners struggle more with pseudo-homophones?

Initially, an ANOVA was utilized to compare the difficulty of recognizing words, nonwords, and pseudo-homophones for the English participants. A second ANOVA compared the French participants' difficulty in recognizing words, nonwords, and pseudo-homophones. Table 2 indicates the descriptive statistics for English learners on WORT. As it is discernible the average elapsed time for recognizing the pseudo-homophones is considerably higher than the real words and nonwords.

Table 2

Descriptive statistics for English participants on WORT

Items	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
Words	25	6.76	1.56	.362	2.65	11.54
Pseudo-homophones	25	14.98	7.90	3.767	8.56	15.00
Nonwords	10	8.34	1.24	.843	5.54	13.25

After checking the homogeneity of the variance via Levene's test, an ANOVA was run to check the possible significance of the differences. Table 3 indicates that the difference in the reaction time for recognizing real words, nonwords, and pseudo-homophones was statistically significant. In other words, real words and pseudo-homophones were significantly different in terms of time taken for participants to recognize. However, the difference between the real and nonwords reaction time was not statistically meaningful. This can imply the challenge of comprehending pseudo-homophones was significantly more than the challenge of recognizing real words and illegal nonwords and, consequently, evidence for the occurrence of GPC.

Table 3

ANOVA comparisons for the advanced English learners

(I) Items	(J) Items	Mean Difference (I-J)	Std. Error	Sig.
Real words	Pseudo-homophones	-7.60	4.840	.001
	Nonwords	-2.80	2.845	.720
Pseudo-homophones	Real words	7.60	4.840	.001
	Nonwords	6.25	3.650	.002
Nonwords	Pseudo-homophones	-6.25	3.650	.002
	Real words	2.80	2.845	.720

Table 4 indicates the descriptive statistics for the advanced French learners on WORT. It is noticeable that similar to English participants, the average elapsed time for recognizing the

French pseudo-homophones is higher than the real and illegal nonwords. Participants spent more time answering items on pseudo-homophones compared to real words and nonwords.

Table 4

Descriptive statistics for French participants on WORT

Items	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Words	25	7.16	1.56	.362	2.32	10.54
Pseudo-homophones	25	13.90	7.90	3.767	8.56	15.00
Nonwords	10	8.31	2.20	1.847	4.54	14.25

Table 5 shows a notable distinction in reaction times across words, pseudo-homophones, and nonwords, demonstrating statistical significance. Like the difference between real words and nonwords, pseudo-homophones exhibited a significant variance in the required time for recognition. Similar to English participants, this variance corresponds to the varying levels of complexity associated with pseudo-homophones' comprehension and the process of GPC.

Table 5

ANOVA comparisons for the advanced French learners

(I) Items	(J) Items	Mean Difference (I-J)	Std. Error	Sig.
Real words	Pseudo-homophones	-8.12	5.320	.000
	Nonwords	-2.65	2.345	.980
Pseudo-homophones	Real words	8.12	5.320	.000
	Nonwords	7.32	3.110	.000
Nonwords	Pseudo-homophones	-7.32	3.110	.000
	Real words	2.65	2.345	.980

The findings suggest that both the advanced learners of English and French had a more challenging recognition of pseudo-homophones in comparison with the real words and the illegal nonwords based on their recorded reaction times. This implies that GPC is not a language-specific phenomenon but a universal cognitive mechanism. Consequently, considering a phonological (not orthographic or semantic) basis for word recognition and retrieval seems to be supportable.

Learners of which language have found pseudo-homophones harder to recognize?

An independent-sample t-test was conducted to evaluate the differences in comprehension of pseudo-homophones among French and English learners. Table 6 indicates French participants demonstrated delayed reaction-times regarding pseudo-homophones compared to their English counterparts. This variance in response latency suggests that the process of GPC is more robust among French learners, as evidenced by their need for additional time to recognize and process linguistic stimuli. The findings underscore the

intricate interplay between language-specific cognitive mechanisms and phonological processing strategies and shed light on the nuanced differences in linguistic acquisition and processing across diverse linguistic backgrounds.

Table 6

Comparing the reaction time of English and French learners for Pseudo-homophones

	Mean Difference	Std. Error Difference	T	Number of Participants	P
French participants	4.23	4.56	8.558	50	.000
English participants	3.26	3.95	3.755	50	
Total	6237.49	399			

This finding implies that, unlike their English counterparts, advanced French learners faced significantly greater difficulty with these deceptive words. This can be related to French orthography, which is more phonemic and inconsistent than English orthography. Furthermore, unlike English, French has fewer true homophones, potentially resulting in less frequent encounters with words requiring disambiguation based on the context. This limited exposure might make advanced French learners less adept at processing the ambiguity inherent to pseudo-homophones.

Discussion

The present study aimed at evaluating EFL and FFL learners' recognition of words, illegal nonwords, and pseudo-homophones in order to evaluate the possibility of GPC occurrence for foreign language learners, which could consequently result in the attestation of phonological (not orthographic) basis for word recognition or lexical retrieval. The results provided affirmative evidence that pseudo-homophones pose a greater challenge for even advanced foreign language learners compared to both real words and illegal nonwords. This aligns with findings from Spieler et al. (2016), who observed slower response times and heightened lexical ambiguity associated with pseudo-homophones in adult native English speakers. The findings were also aligned with Mechelli et al. (2003), who confirmed a similar challenge for skilled readers of German, indicating the cross-linguistic applicability of these difficulties. This claim is also in line with Brysbaert et al. (2009), who emphasized the persistent effect of lexical competition even in highly proficient readers. Even though advanced learners possess strong vocabulary knowledge, the activation of competing lexical representations due to shared written forms creates uncertainty and demands deeper analysis, leading to slower and less accurate recognition of pseudo-homophones.

The findings also demonstrably indicated that GPC, the process of mapping written symbols (graphemes) to their corresponding sounds (phonemes), occurs effectively in both advanced English and French learners. This is aligned with the findings of Bialystok et al.

(2010), who emphasized that learners, regardless of their L1 or L2, rely on this process to establish sound-symbol associations and achieve reading fluency. This claim also supports Ziegler and Goswami (2005), who demonstrated the crucial role of GPC in establishing these associations and achieving reading fluency. The presence of GPC in advanced learners is in line with Perfetti and Hart (2001), who highlighted that the basic principles of mapping written symbols to sounds remain consistent across languages. Moreover, the findings align with what Huntsman (2007) claimed about the exertion of phonological information (but not frequency codes) for lexical retrieval. However, unlike the outcome of this study, Lupker and Pexman (2010) claimed that pseudo-homophones' mechanism of semantic activation is quite different from that of real words.

The observed trend, where participants from both French and English language backgrounds required more time to recognize pseudo-homophones compared to other stimuli, suggested the occurrence of GPC across linguistic boundaries. This phenomenon indicates that when confronted with words that phonetically resemble each other but have distinct meanings, individuals engage in a phonological decoding process to access the correct lexical representation. The necessity for additional processing time implies that participants are actively employing phonological strategies to disambiguate between similar-sounding words, highlighting the phonological basis of lexical retrieval. These findings align with Damian and Bowers (2003), who proposed that phonological encoding plays a crucial role in accessing and retrieving lexical information from memory. They claimed the central role of phonology in facilitating efficient lexical retrieval across diverse linguistic contexts.

Overall, the findings underscore the *Dual route* model of word processing, which asserts a phonological basis for word recognition and retrieval compared to the Connectionist models, which do not consider any priority for any phonologic, orthographic, and semantic representations for word recognition. The non-language-specific nature of GPC makes it possible to claim that the *Dual route* model describes word recognition as a universal mental mechanism in a more empirically verifiable way.

The more problematic recognition of the pseudo-homophones by advanced French learners may be associated with the nature of the French orthography which does not allow for constructing pseudo-homophones. The discrepancy between French phonology and orthography and the widespread existence of silent letters in French orthography may also be other reasons for justifying French learners' more serious cognitive challenge for recognizing pseudo-homophones. This aligns with what Alario and Ferrand (2009, p. 547) claimed: "The lexical ambiguity triggered by orthographic similarity in French would be troublesome even for the skilled native readers."

Conclusion

The findings revealed that pseudo-homophones cross-linguistically posed a greater

challenge for advanced foreign learners compared to real words and nonwords. The longer elapsed times for pseudo-homophones indicated an increased cognitive load, supporting the hypothesis of heightened difficulty in recognizing these linguistic constructs. The study provided empirical evidence supporting the occurrence of GPC across different language backgrounds. Instructors can integrate GPC exercises into the curriculum, focusing on activities that require learners to decode and pronounce words accurately. Furthermore, GPC suggests a sequential approach to teaching phonics, starting with basic letter-sound correspondences and gradually progressing to more complex ones. This sequential learning approach helps learners build a strong foundation in decoding words.

Exploring the procedures that foreign language learners experience in word recognition can help make informed decisions about the subsequent approaches toward a successful teaching process. The results can also be effective in understanding the sources of problems for those who have problems in reading and/or vocabulary learning and comprehension. By emphasizing GPC, instructors can enhance students' ability to recognize words, facilitating smoother and more efficient reading. This, in turn, contributes to improved comprehension as students spend less cognitive effort on decoding individual words. In multilingual settings, educators can leverage GPC instruction to support learners in understanding sound-symbol relationships in various languages, promoting transferable skills. Integrating pseudo-homophones into grammar lessons can also give learners practical examples of how grapheme-phoneme conversion influences sentence structure and punctuation. This application-oriented approach can enhance both language comprehension and writing skills.

The proficiency level disparity between FFL learners and EFL learners has to be considered as a factor contributing to nuanced differences in their experiences with GPC. Furthermore, future investigations are needed to delve deeper into these nuances and distinctions, fostering a more comprehensive understanding of reading comprehension processes among language learners. Longitudinal studies can provide insights into the developmental trajectories of these cognitive processes, helping educators tailor interventions to different stages of language acquisition. It is also an empirical necessity to examine how cultural and educational contexts influence the GPC process and pseudo-homophones' recognition.

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