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Disambiguating ambiguity: A comparative analysis of lexical decision-making in native and non-native English speakers

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ABSTRACT

Making lexical decisions to disambiguate multiple-meaning words or senses provides clear evidence of word recognition, processing systems and representation in the mental lexicon. This comparative study explores non-native English speakers' and native English speakers' cognitive mechanisms employed in phonological and lexical ambiguity resolution embedded in auditory and visual utterances. English proficiency and vocabulary tests and two lexical decision tests were conducted with 35 EFL undergraduate students and four native English monolingual speakers. The effects of factors such as L2 proficiency and familiarity on ambiguity resolution in addition to the resolution techniques employed were also explored. Our findings suggest that the differences in disambiguating L2 words among native English speakers and non-native English speakers might indicate different comprehension, representation and processing patterns. The ambiguity type most likely has a major role in determining the diverse phenomenon of ambiguity resolution. More specifically, there was evidence of significant differences in homophone use, metaphorical polysemy and homonym ambiguity resolution between the two groups, excluding metonymous polysemy. Homophones and polysemy were the least problematic and challenging lexical ambiguity types unlike homonymy for the non-native group. Other results also revealed the positive effects of L2 proficiency and L2 word familiarity on ambiguity resolution. Thus, this study also has important implications considering the vital role of vocabulary in L2 competence and knowledge.

Contribution/ Originality: This study considerably extends the existing body of research addressing how bilinguals process the under-researched metaphorical and metonymical polysemous words by comparison with a group of native English speakers to explore ambiguity resolution and word recognition. The findings contribute to our understanding of the role of vocabulary knowledge among bilinguals in word recognition and processing in EFL contexts.

1. INTRODUCTION

Vocabulary is an essential aspect of learning and using a second language (L2) and its improper use may hinder communication regardless of sentence grammaticality. Vocabulary is one of the most consistently demanding areas of investigation in linguistic research with lexical ambiguity being especially important. Such ambiguity is a semantic phenomenon that refers to the co-existence of multiple meanings for a single word. New concepts are constantly introduced because of the dynamic nature of languages and the demands of modern society. However,

humans often choose to expand the meaning of already existing words rather than invent new ones which results in the creation of words with numerous meanings (Bianqi, 2014). Lexicographers scrutinizing word ambiguity distinguish between polysemy and homonymy by considering the relatedness of the meaning issue between words. Systematic ambiguity also known as polysemy is a term used to describe words with closely related senses regardless of their various contextual interpretations. For example, the word "twist" has several related definitions such as "to operate by turning or to alter the shape of" or "foot" (Rodd, Gaskell, and Marslen-Wilson, 2002) or the word 'foot' (of the bed, of a person and of a mountain) (see Yule, 2010). On the contrary, homonyms (accidental ambiguity) deal with words that are identical in spoken and written forms but have semantically unrelated meanings such as the word "bark" which means either the sound a dog makes or part of the tree (Rodd et al., 2002). L2 English speakers and learners can greatly benefit from knowing these words as a basic vocabulary and for text comprehension due to the fact that polysemous terms make up over 40% of the English vocabulary and are among the most often used words(see Alnamer, 2017). In research, homonyms changing denotative meaning are also problematic for L2 users (e.g., Demir, 2020; Yu, Xu, & Sun, 2011).

Understanding recently added meanings to words that already exist and developing one's skill in using them effectively can help one overcome any miscommunication by conveying the intended meaning and revealing hidden messages in any discourse type. There is a potential level of ambiguity in interpretation even though it is not shown that words with numerous meanings could just mean vagueness (Demir, 2020). However, working on word ambiguity resolution is still one of the most challenging tasks for bilinguals (see Almahameed (2020)) with insufficient exposure to their second languages especially in foreign language learning contexts (EFL). English is considered a foreign language (FL) in Jordan although learning English starts early from kindergarten to university. Still, English is mainly used in educational contexts. The increasing demands for mastering highly effective language skills either as part of job requirements or as a result of a great openness to others through social media platforms have elevated its status. Thus, this study attempts to explore how Jordanian EFL learners manage English vocabulary ambiguity to clarify its implications for comprehension and vocabulary usage.

1.1. Linguistic Ambiguity and Context

Lexical ambiguity resolution is an effective indicator of language processing and word recognition and language ambiguity has been demonstrated to be a persistent issue in natural language processing. Language or linguistic ambiguities are divided into structural and lexical ambiguities. The former deals with structural forms, referential ambiguity, word order and prepositional phrases while lexical ambiguity deals with words and their different meanings conveyed through homophones and polysemy (Bucaria, 2004). Thus, ambiguity resolution processes and mechanisms have attracted the attention of many linguists and researchers in fields such as psycholinguistics and cognitive psychology who have confirmed that ambiguous sentences compared with unambiguous sentences are cognitively more challenging to handle and are normally processed with different resolution mechanisms (Bucaria, 2004). Cognitive linguistics mainly explores how human cognitive abilities and thinking processes determine the formation of concepts particularly those carrying multiple senses such as polysemous words (Lin, 2021). Still, lexis and grammar are interrelated in that the meanings of words determine and predict their syntactic features in a sentence as in the near-synonym hide or conceal (Curse, 2000). Another source of ambiguity identified in research is phonological ambiguity which involves homophones. They are defined as two or more words that have the same pronunciation but differ in form and meaning (Yule, 2010).

Lexical ambiguity is "ubiquitous" because the majority of popular English words contain multiple dictionary entries. The intended meaning of a word can only be determined by choosing the context-appropriate interpretation for it (Rodd, 2018). When users of a language experience semantically or lexically ambiguous constituents of a sentence, they are normally able to determine at least one meaningful interpretation, ignoring any other probable meaning (Rodd, 2018). Normally, a user's bias towards the dominant primary meaning of words that were acquired

first and activated might hinder access to the required secondary or subordinate meaning unless they are placed within a specific context (Abdurrahman & Jawad, 2019; Qin, 2022). Thus, the less dominant meanings of a target lexical unit create a source of ambiguity and misunderstanding that can be resolved through contextually provided information. Other extra-linguistic cues such as the speaker's style (using literal or non-literal speech) also determine semantic processing (Davies, Porretta, Koleva, & Klepousniotou, 2022). Some addressees rely on speakers' previous utterances to restrict the interpretation choices and predict the succeeding "linguistic material" (Davies et al., 2022). In this context, successful language communication and comprehension result from the addressees' ability to deduce the speakers' intended meanings of linguistically ambiguous words that convey multiple possible interpretations (Klepousniotou, Pike, Steinhauer, & Gracco, 2012). It is not only the ambiguity or vagueness of utterances that impacts addressees in spoken contexts considering that there is a chance to negotiate meaning to solve any ambiguity but they may remain unsolved in written contexts as writers do not receive direct feedback from readers (Ali, 2015).

There is a conceptual relationship and sense to all word meanings. Polysemy is classified into two categories: metonymic and metaphorical polysemy (cf. Apresjan (1974) cited in Klepousniotou (2002)) or non-linear polysemy (see Curse, 2000). Metaphorically motivated polysemy is based on the analogical relationship between the senses of a word in which the basic sense of polysemy is literal and the secondary sense is considered figurative. For example, the literal sense of the word 'eye' is an "organ of the body" and the figurative sense is a "hole in a needle." Subsequently, the metonymical polysemy is based on the contiguity relation that holds between the word senses and the basic and secondary senses of polysemy are literal (Klepousniotou, 2002). The word "chicken" is considered an example of metonymical meaning. The basic meaning refers to "animal" while the second meaning refers to a type of meat (Klepousniotou, 2002). The relationship between homonymy and polysemy is that both are relative concepts in which homonymy is closer to metaphorical polysemy than to metonymically motivated polysemy (Klepousniotou, 2002). Metaphorically and metonymically motivated polysemy is described in terms of cognitive phenomena. Metaphors indicate a parallel relationship between concepts (meanings) with some similarity between them whereas metonymy deals more with perceptual representations in the cognitive domain (Lin, 2021).

Word comprehension is a difficult process that requires passing through several phases in order to activate the meaning that is intended (Almahameed, 2020). Homonymous and polysemous words have different processing mechanisms and representations of the mind (Klepousniotou et al., 2012). When it comes to activation processes, homonymous words take longer than polysemous words to activate in either isolation or sentence contexts because their multiple meanings can have a distinct representation in the "mental lexicon" which is a list of senses that already exists. The rapid processing of metonymical polysemous words indicates that related meanings are not competing and that a single mental representation is allocated to the basic word sense (as well as its extended meanings derived from the general meaning value). Thus, processing and comprehension differences exist between highly overlapping polysemous words in meaning (metonymous words) moderately overlapping polysemous words (metaphorical words) and low overlapping homonymous words (Klepousniotou, Titone, & Romero, 2008). In other words, words with multiple related senses considered rich in semantic representations facilitate meaning recognition compared with competitions associated with multiple unrelated meanings of words which result in recognition delays (Rodd et al., 2002).

Giora (2003) describes the relationship between the context effect and lexical access as follows: "Lexical access pertains to the quick activation of word meanings when a linguistic stimulus occurs in and out of context" (p. 40). Language users can identify words and their intended meanings by looking at the context in which they are used. The co-occurring words that surround a word with a different meaning create a local context that helps the reader understand the meaning of the term within a sentence (Ovu, 2011). One source of lexical ambiguity is the placement of words in isolation where different interpretations might confuse language users. For example, the word "bank" holds two unrelated meanings (financial institution and side of a river) and the ambiguity can be resolved when

placing it within a linguistic context. Dash (2008) identified four types of contexts that help language users determine the meaning of intended words: local, sentential, topical and global contexts. These types provide users with different possible sources to reach intended meanings when one context fails to provide users with an understanding of the actual intended meaning in another context. According to Dash (2008) the local context deals with one or two words neighbouring the keyword while the sentential context deals with all units or forms in a sentence that go beyond the first type. The topical context goes beyond the sentential context and refers to the topic while the global context deals with meaning in the world (the extra-linguistic world). Dash (2008) also argues that users usually refer to the local context to capture the actual intended meaning from neighbouring words and in most cases, retrieving information from this context is not sufficient. Therefore, users must consider other contexts to extract the necessary information to decipher the meaning of the word.

1.2. Models of Language Processing and Meaning Accessibility

Various models have been proposed to account for the multiple meanings of word processing systems and accessibility. For example, the Graded Salience Hypothesis addresses meaning processing and comprehension. According to this hypothesis (see Giora, 2003) lexical access is based on two mechanisms: one sensitive to specific linguistic information and the other sensitive to extra-linguistic and linguistic contextual knowledge. It also proposes that more salient meanings (or coded meanings) in language users' minds are retrieved and activated faster than less salient meanings regardless of any supportive contextual information. Consolidation which comprises coding and storing in the mental lexicon makes salient information far more accessible than non-salient information. The saliency of coded meanings depends on frequency, conventionality, prototype and familiarity. Contextual information is said to influence comprehension and meaning derivation which may be faster than biased lexical or linguistic processes in obtaining meaning leading to effective inferential and guessing processes. Although contextual information sometimes constrains lexical access early, this influence does not prevent more salient and congruent meanings from being retrieved and accessed. This hypothesis contends that another problem with the mental lexicon as stated by Giora is that it allows for both specified entries and underspecified meanings of individual words with the meanings representing their semantic features as a network assuming that they are distributed in layers.

The reordered access model by Kellas and Vu (1999) is based on exhaustive retrieval of the appropriate meaning of ambiguous words in all contexts and on the biasing context effect on reordering meaning availability by boosting the activation process of contextual proper sense. However, inappropriate meaning is also sometimes accessed. This is consistent with the view that all meanings of an ambiguous word are possibly accessed and activated when faced at the comprehension stage and that there is a need for further contextual inferential means to reach the intended meaning. In contrast, the selective access model (or context-dependent model) (see Almajdoa, 2016; Simpson, 1981) postulates that the appropriate meanings of ambiguous words are activated only in the context. According to Kellas and Vu (1999) the strength of the context determines the meaning activation pattern and prevails over the subordinate meaning. Modularity and interactionism represent two cognitive mechanisms in the selective model in which the modularity view deals with separate modules processed independently in language processing (Almajdoa, 2016) whereas the interactive activation view deals with processing units of any level (including semantic, syntactic and word levels) that store knowledge on adjacent levels. Processing at any level affects processing at above or below levels (McClelland, 1987).

The generative lexicon approach (see Klepousniotou, 2002; Pustejovsky, 1995) focuses on the accessibility and processing of mental lexicons. It deals with core word senses and their internal structures that generate new specific senses of meaning required by a specific context and addressees' sense accessibility differences between polysemy and homonymy based on their storage in the mental lexicon. For polysemy, basic senses are only stored in the mental lexicon and any extended senses required by a context are normally generated from lexical rules

derived from the core senses. This is compared to homonymy where different senses are claimed to be stored apart. This implies that the type of word ambiguity determines the form processed.

According to Katz and Fodor (1963) as cited in Qin (2022) the approach which is based on projection rules and dictionaries examines the relationship between word meaning and sentence meaning. At the word level, dictionaries provide word entries and their meanings whereas at the sentence level, projection rules are activated when learners attempt to disambiguate a multiple-meaning word and determine the appropriate meaning or sense of ambiguous words within a sentence. Additionally, the semantic relations of words function as semantic markers within a sentence to resolve ambiguity.

An important issue that needs to be highlighted is word ambiguity which plays a fundamental role in language comprehension and might lead to lexical errors in addressing these approaches to lexically ambiguous word processing. James (1998) discusses the central role of the lexis in language learning considering that most error types are linked to vocabulary and vocabulary errors are the most disturbing and irritating error types for native speakers. This indicates that misinterpretation of an ambiguous lexis will unquestionably lead to miscommunication. Therefore, researchers have focused on ambiguity resolution strategies to increase the chances of meaning prediction. Rajendran and Vidyapeetham (2014) have claimed that ambiguity resolution can be classified using different strategies even without depending on the immediate context. Strategies employed include parts of speech, "semantic relations" (associating with neighbouring words), "sense frequency" or "preferred sense" based on domain, semantic features, "role-related preferences" or "selection restrictions" (dealing with semantic features that allow a sense or meaning of a word to combine with other words in the same context). The use of dictionaries or Bayesian classification methods has also been proposed to resolve this ambiguity. The user must select between the dictionary's suggested meaning and the intended meaning based on context when using it to resolve ambiguity. As a result, using a dictionary to resolve ambiguity is only a very practical method. In contrast, Rajendran and Vidyapeetham (2014) argue that the Bayesian method is considered a highly complex approach as it requires the classification of words associated with an ambiguous word according to its competing senses. The role of context is central to ambiguity resolution although other strategies may also be employed to disambiguate words.

2. LITERATURE REVIEW

Several previous studies have addressed the issue of ambiguity and ambiguity resolution using identified subtypes. The ambiguity-resolution processes of monolingual native English speakers (Beretta, Fiorentino, & Poeppel, 2005; Davies et al., 2022; Klepousniotou, 2002; Klepousniotou et al., 2012; Rodd et al., 2002) and non-native English speakers from various backgrounds in various contexts were the subject of a line of research prior to bilingual research studies (Al-Farra, 2020; Almahameed, 2020; Qin, 2022). The following review of the literature will only cover studies on bilinguals' English word ambiguity because of the present research focus.

Al-Farra (2020) conducted a study to discover the lexical errors that sixth-grade students in Gaza committed when identifying synonyms, homonyms, antonyms and homophones by addressing different lexemes in Arabic and English. The study sample demonstrated difficulties with synonyms and homophones. The source of difficulty is the type of relationship between words that might have related or unrelated meanings in various word classes or categories.

Another study by Almahameed (2020) indicated that participants found it difficult to resolve structurally ambiguous and lexical (homographs or homonymy) statements considering that the number of resolved statements was less than the number of unresolved statements. Almahameed (2020) investigated how 17 undergraduate EFL learners work to resolve syntactic and lexical ambiguities through a translation task. Participants mostly depended on syntactic class and meaning dominance when interpreting statements to resolve ambiguity.

A study conducted by Abdurrahman and Jawad (2019) indicated that Iraqi participants failed to distinguish between polysemy and homonymy and between ambiguous and unambiguous sentences. The participants were

given a task to pin down and distinguish between polysemous and homonymous words and another task to distinguish between ambiguous and unambiguous sentences. These findings suggest a shortage of vocabulary storage that is based on semantic relations. The unfamiliarity and lack of acquaintance with other extended meanings for both polysemous and homonymous words which in turn overwhelmed their choices of intended meanings was another interpretation of the participants' failures in the tasks. The findings demonstrated that increasing awareness of polysemy and homonymy (especially among non-native L2 subjects) contributes to a better understanding of their comprehension and meaning retrieval processes.

In a study conducted in the English context, Almajdoa (2016) examined the processing of homonymy and polysemy among a group of L2 learners of English studying in the US compared with a group of native speakers of English. Using the "self-paced reading method" with three groups of words classified as polysemy, homonyms and single-meaning words, the results revealed no effect of ambiguity type or word dominance on lexical processing between the two groups of participants in the study. Additionally, using contextual information was maintained as helpful for non-native speakers of English who interactively processed sentences and accessed context-supported meanings.

Qin (2022) employed a corpus-based methodology to gather data on homonym misuse and usage patterns in essay writing. The study involved a sample of undergraduate students from Malaysia. The sample employed is different types of homonyms, classified as homographs, homophones, lexicogrammatical homonyms and lexical homonyms. The findings showed how context plays an essential role in resolving ambiguity regarding homonyms' numerous meanings and how the word class of homonyms plays a role in interpreting meaning or sense within a context. Moreover, usage patterns while forming sentences are influenced by factors such as L1 transfer, phonetic and lexical structure similarity confusion, experience bias and a lack of understanding of homonyms.

Measuring the awareness of polysemous words and their extended meanings plays a central role in the semantic disambiguation of words faced by EFL learners. In a study conducted in the United Arab Emirates, Alnamer (2017) investigated awareness using a translation test of three polysemous words (open, run, and make). The samples were split into two groups: advanced and intermediate learners in order to quantify the competence effect based on the level of the courses taken during the study period. The study revealed that their low awareness of polysemy in English was the reason for predicting only the primary meaning of words rather than their extended meanings which were considered difficult for them. The results also showed that other factors such as additional context cues or familiarity with the context significantly aided in predicting the target meaning of polysemous words and that proficiency level determines one's ability to predict the meaning of polysemous words.

Providing contextual cues may play a role in disambiguating lexical words and enhancing cognitive processing. In a study conducted by Iravani and Ghasemi (2012) it was indicated that an Iranian sample performed different tasks including different cues (elaborated context, semantic frames and meaning chains) to measure their knowledge of multiple meanings of intended words and help them work on the ambiguity resolution of polysemous senses. Semantic frames include the verb cue of a semantic frame similar to the target word while meaning chains include a group of sentences that represent the core sense of the target word and other related senses. The results demonstrated the effect of an elaborate context with its information cues as a helpful resource for predicting unfamiliar senses of polysemous words. The other types of cues were less powerful because the participants failed to connect the cues to the target senses. Although L1 interference clearly influenced learners' access to the primary word concept, they benefited from background semantic frames to recognize and understand word senses.

Krimat and Friekh (2022) study in the Algerian context used a test and an interview with an EFL sample to discover the resolution strategies used to sort out lexical ambiguity which helped clarify lexical ambiguity resolution procedures. The results indicated that the participants relied on strategies such as theme and selection restrictions to clarify some lexical ambiguities despite their immense struggle with polysemous word ambiguities.

The examined previous studies share a common element: their focus on L2 English learners or users from different L1 backgrounds regardless of the techniques used or tests applied. Bilinguals may have alternative meaning-processing strategies for being able to store, retrieve and access information from two distinct language systems in their minds. In this respect, most research on lexical ambiguity has focused on monolingual speakers of a language and argued that the forms of ambiguity differ among bilinguals who access two different language systems. Therefore, they face higher ambiguity levels compared to monolinguals (see Rodd, 2018).

2.1. Significance of the Study

The motivation for conducting the current study arises from the need to fill a gap in research by contributing new findings in different contexts, samples or techniques. The significance of this paper stems from its aims and focus. First, the effect of polysemous words' subtypes, namely metonymical and metaphorical polysemous words, on word recognition and processing was not studied in any bilingual research study on lexical ambiguity for polysemous words in contrast to monolingual studies. It was assumed that investigating the subtypes of polysemy might add to our understanding of how bilinguals process them with differences in focus in addition to other traditional types of lexical ambiguity such as homonyms. Additionally, word knowledge was regarded as an "incremental process" given that L2 users may possess restricted and incomplete knowledge about a particular word and its meanings in that language compared with native speakers (Alkhathlan, 2007). In the current comparative study, including an English native speaker sample creates a comparison with non-native English speakers to understand whether they differ in the disambiguation of lexical ambiguous multiple-meaning words.

Most previous studies have not addressed this comparative issue as they focused only on English L2 users and ambiguity resolution. Few studies have addressed both native English speakers and non-native English speakers either in the English native context (e.g., Almajdoa, 2016) or other English L2 contexts not in the Arab context. This study investigated the direct relationship between L2 proficiency as determined by L2 language and vocabulary tests and ambiguity resolution taking into account the possibility that the influence of English status in non-native English-speaking countries may affect L2 users' exposure to English and their proficiency in it. The majority of research have either not examined the impact of L2 proficiency on L2 ambiguity resolution or has simply measured it in order to assist in proficiency-based sample selection. The effect of L2 word familiarity with non-native participants was also measured rather than word dominance as examined in other studies. The English corpus is largely used to determine word-meaning dominance (see Almajdoa, 2016) and this corpus served as the basis for classifying the dominance of the chosen words. Another significance of our research is that it is based on both auditory and visual presentation techniques for all utterances to enhance the participants' chances of predicting multiple meanings of ambiguous words. Exposure to auditory stimuli helps in the word recognition process in which the hearer tries to match spoken input with the mental representation of targeted words to select the best word among all activated choices (Wang, Hui, & Chen, 2020). According to semantic studies, extralinguistic cues like speakers' style also play an essential part and are contextual determinants in the interpretation and disambiguation of polysemous words (Davies et al., 2022). In addition, linguistic contexts offer cues to predict and get the intended meaning. Therefore, its effect on ambiguity resolution in this study was measured using a self-assessment report of a non-native group of participants.

The current study attempts to answer the following research questions to investigate the lexical and phonological ambiguity resolution mechanisms employed by a group of native English speakers and a group of non-native English speakers:

1. Do undergraduate university EFL learners find it challenging to resolve lexical ambiguities (namely, metaphors, metonymy and homonymy) and phonological ambiguities (focusing on homophones) and which type of ambiguity is the most challenging?

2. Are there any statistically significant differences between native and non-native English speakers in lexical and phonological ambiguity, word resolution and meaning dominance of the English lexicon?
3. To what extent are the auditory presented utterance technique and familiarity with the English lexicon helpful for ambiguity resolution for non-native speakers? What ambiguity resolution techniques are employed by the non-native group of participants?
4. Is there any relationship between ambiguity resolution for all types of ambiguity and L2 proficiency among non-native English speakers?

3. METHODS

3.1. Research Design

This was a descriptive empirical study that employed a quantitative approach to explore differences between non-native (experimental group) and native English speakers (control group) in phonological and lexical ambiguity resolution by using phonological and lexical decision tests. L2 proficiency and vocabulary tests were used to measure English proficiency and a questionnaire was designed to determine the effects of factors such as L2 word familiarity and auditory lexical decisions in addition to the resolution techniques employed on ambiguity resolution to obtain reliable results. The research materials addressed all issues pertaining to the study's focus. The study was conducted in three phases: English proficiency and vocabulary tests, lexical decision tests and rating scales for L2 word familiarity, auditory lexical decision and lexical resolution strategies. A descriptive statistical analysis was carried out to present the results. The following sections provide detailed information on the study methodology.

3.2. Participants

The voluntary sample that participated in the current study was a group of non-native English speakers as the experimental group and another group of native speakers of English as the control group. The first group included 35 advanced EFL undergraduate students enrolled in the English department at Al-Hussein Bin Talal University in Jordan. The second group consisted of five educated female American native speakers of English (none of whom spoke another language) willingly agreed to participate in this study. Four agreed to participate in the study as a control group and the fifth only helped in recording utterances used in the test.

3.3. Materials and Procedures

Two instruments were used to achieve the aims of this investigation. The first instrument was designed to measure L2 proficiency using English proficiency and vocabulary tests. A version of the TOEFL (Test of English as a Foreign Language) test was used to evaluate non-native English proficiency in addition to the vocabulary test developed by Paul Nation to measure L2 users' English vocabulary size and depth of vocabulary knowledge (accessed from Nation, 2023). In other words, only non-native speakers of English participated in the two parts of the proficiency tests considering that native speakers outperform non-native speakers in that they know their first language comprehensively and perfectly and they only commit mistakes when distracted (see James, 1998).

The other main instrument developed for the present study was divided into two lexical decision tests to examine how participants worked on phonological and lexical ambiguity resolution. The list of words and sentences used in the study was adapted from Curse (2000), Klepousniotou (2002), Klepousniotou and Baum (2005), Almajdoa (2016) and the Oxford Learner and Merriam-Webster dictionaries. The developed test generated four word groups, 13 transcribed ambiguous words for homophones, nine ambiguous words for metaphorical polysemy, 10 ambiguous words for metonymical polysemy and 10 ambiguous words for homonyms (see the target words listed in Tables 1 and 2).

A better understanding of the effects of a wide range of ambiguous words and their meaning extensions is provided by the inclusion of different types of word relations especially when examining metonymic and metaphorical words considering the lack of standardized lists of ambiguous words (Klepousniotou & Baum, 2005).

In this study, all words were placed in sentences to provide contextual information for each ambiguous word. Each ambiguous word was placed in two different contexts (dominant and subordinate) to elicit different meanings for the same word. For example, the word "sense" which is considered an example of a homonym was placed in two different sentences to provoke accessibility to its two unrelated meanings, namely, "feelings" in one sentence and "meanings" in another.

Ethical issues including permissions obtained from the participants, data anonymity and confidentiality were all taken into consideration prior to conducting this study. The procedures were conducted in more than one session (between 30 and 45 minutes each) because of the varied materials used in the study. Instructions were provided to the recruited participants in each session to ascertain their knowledge of the tasks required at each stage. The non-native group of participants first took a proficiency test to measure their general English competence. They were then asked to complete a vocabulary size test to measure their vocabulary and knowledge of meanings.

In contrast, the second part of the instrument which measures lexical ambiguous resolution was administered to both groups of participants in a separate session one week after attending the proficiency test. A native speaker was asked to record all sentences with an emphasis on the ambiguous word in each sentence before the main computerized lexical test was applied. The main part of the study was applied only to both groups. They noted the sentence's potential meaning after hearing the target word three times in the sentential context and seeing it displayed on the computer screen.

Only non-native speakers were given a chance to rate their familiarity with each meaning of an ambiguous word on a four-point Likert scale where 1 indicates high frequency and use and 4 indicates never used while answering the test. Subjective familiarity which has not been considered in most studies was considered an indicator of non-native subjects' competence and knowledge of words in the current study.

The auditory technique has been used as an assistive tool to improve word-meaning retrieval from the mental lexicon taking into account the impact of auditory lexical decisions. The non-native participants who completed the test were asked to rate the effect of hearing words first on their meaning prediction rank from 1 (to a great extent helpful) to 4 (not at all helpful) in addition to referring to any strategy they used in predicting intended meanings.

4. RESULTS

This study investigated lexical and phonological ambiguity resolution by two groups of participants. A statistical analysis was performed to calculate frequencies, means (M) and standard deviations (SD) and a t-test analysis was used to identify any differences between groups of participants to answer the research questions.

4.1. Lexical and Phonological Ambiguities

A study of undergraduate university EFL learners' recognition of the examined lexically and phonologically ambiguous words was conducted to determine whether or not they view disambiguating lexical and phonological ambiguities as a challenge. Table 1 illustrates the percentages of correctly answered meanings of the homophones. The results demonstrate that non-native speakers of English easily recognize most homophones. However, there was considerable difficulty in disambiguating the pairs sum/some (20%) and seen/scene (45.6%) in the non-native speakers' sample. Although the pair tail/tale was used in two different sentences, the percentage of responses was nearly the same.

Table 1. Target words selected for phonological ambiguity (homophones) for non-native English speakers (in %).

Homophones	Intended target	Percentage %
Some or sum	Sum	20.0
Sale or sale	Sale	79.0
Flower or flour	Flower	86.6
A nice or an ice	A nice	91.3
Allowed or aloud	Allowed	60.9
Tail or tale	Tail	68.4
Tail or tale	Tale	65.6
A name or an aim	A name	92.3
Scene or seen	Scene	45.6
Whole or hole	Whole	71.3
Stuffy nose or stuff he knows	Stuffy nose	72.3
Waste or waist	Waist	82.7
Dear or deer	Dear	85.6

Table 2 presents the percentage of responses provided by the non-native group of participants regarding the results of their disambiguation of contextualised lexically ambiguous words. The words were classified according to their dominant and subordinate meanings and the participants generally predicted the intended meaning of each ambiguous word regardless of the type of ambiguity.

Table 2. Target words selected for lexical ambiguity (percentage in brackets).

Target words	Dominant meaning	Subordinate meaning
Polysemy/ Metaphor		
Neck	Throat (85.2)	Narrow (67.2)
Arm	Wrist (92.9)	Couch (91.9)
tongue	Lick (77.5)	Laces (50.1)
Chicken	Hen (78.1)	Scared (79.1)
Star	Universe (90.3)	Famous (85.2)
Spice	Herb (74.9)	Thrill (80.1)
Gem	Stone (64.7)	Unique (61.1)
Pillar	Column (69.8)	Model (61.1)
Position	Way (90.3)	Situation (92.9)
Polysemy/ Metonymy		
Bag	Luggage (87.2)	Garbage (82.1)
Basket	Weave (79.9)	Laundry (70.7)
Arena	Stadium (78.4)	Concert (74.8)
Glass	Crystal (88.1)	Juice (85.2)
Cage	Metal (79.2)	Animal (76.0)
Pine	Tree (80.9)	Smell (75.1)
Mouth	Food (87.8)	People (85.2)
Skirt	Clothes (79.5)	Covering (71.2)
Wheels	Round (83.4)	Vehicle (78.5)
Voice	Sound (90.6)	Representative (88.9)
Homonymy		
Park	Bench (67.2)	Vehicle (69.4)
Foil	Silver (57.0)	Fool (40.6)
Toll	Fee (64.7)	Bell (45.7)
Perch	Branch (67.2)	Fish (59.5)
Mint	Candy (58.5)	Coin (44.2)
Band	Musicians (70.8)	Rubber (67.2)
Spring	Season (73.6)	Water (63.7)
Sense	Feeling (70.8)	Meaning (66.2)
Story	Tale (78.6)	Floor (82.7)
Tank	Container (77.1)	Military (79.6)

The percentages obtained for items varied between very high for polysemous words such as arm and position and low for some homonymous words such as toll, foil and mint especially when dealing with their subordinate meanings. The percentages of dominant and subordinate meanings for most ambiguities were similar (e.g., star, chicken and glass). However, another finding was that the subordinate meaning was more frequent than the dominant meaning in homonymous words such as park, tank and story and polysemous words such as spice and position.

Another analysis was performed to explore which of the investigated ambiguity types presented a source of challenge and difficulty for non-native participants. Table 3 presents the M and SD scores of each ambiguity type examined in this study. The findings revealed that polysemy (particularly metonymy) had the highest mean scores (M=2.54, M=2.50) followed by homophones (M=2.62) and polysemy metaphors (M=2.49). Homonymous words received the lowest mean score among all types of ambiguities (M=2.42).

Table 3. Mean scores and SDs for ambiguity types for non-native English speakers.

Ambiguity types	Mean	SD
Homophones	2.62	0.69
Metaphor	2.49	0.57
Metonymy	2.54	0.60
Polysemy	2.50	0.58
Homonymy	2.42	0.47

4.2. Native Speakers and Non-Native Speakers and Ambiguity Resolution

An independent sample t-test was employed to investigate any statistically significant differences between the two participant groups and ambiguity-type resolution (see Table 4). The results indicated that there were statistically significant differences in lexical and phonological ambiguity resolution among native and non-native speakers except for metonymy. Native speakers' M scores were found to be significantly higher than those obtained by non-native speaker which in turn means that they outperformed non-native speakers in terms of lexical resolution. Although there were significant differences between the two groups in terms of those that appeared to have significantly different M scores, the biggest difference was in homonymy in favor of native English speakers (native speakers M=2.88, non-native speakers M=2.42, P=0.019).

Table 4. T-test analysis of differences between native and non-native speakers and ambiguity type.

Ambiguity types	Participants	Mean	SD	P value (Sig.)
Homophones	Native	2.90	0.94	0.025
	Non-native	2.62	0.69	
Metaphor	Native	2.85	0.89	0.050
	Non-native	2.49	0.57	
Metonymy	Native	2.79	0.83	0.113
	Non-native	2.54	0.60	
Polysemy	Native	2.83	0.86	0.026
	Non-native	2.50	0.58	
Homonymy	Native	2.88	0.93	0.019
	Non-native	2.42	0.47	

An independent sample t-test study was conducted to identify any potential differences between the two groups based on word-meaning dominance with regard to differences resulting from the predominance of ambiguous English words. Table 5 illustrates that the lexicons meaning dominance or subordinates differed between the two groups. Although neither group of participants demonstrated differences in the use of polysemous words with dominant meanings (p=0.40), there were significant differences in the use of polysemous words with subordinate meanings and homonymous words with both dominant and subordinate meanings.

Table 5. T-test analysis of differences between the two groups and dominance.

Ambiguity types	Participants	Mean	SD	P value (Sig.)
Polysemy dominant	Native	2.92	0.94	0.40
	Non-native	2.72	0.81	
Polysemy subordinate	Native	2.90	0.93	0.023
	Non-native	2.60	0.67	
Homonyms dominant	Native	2.89	0.91	0.030
	Non-native	2.53	0.61	
Homonyms subordinate	Native	2.87	0.91	0.050
	Non-native	2.40	0.52	

4.3. Resolving Word Ambiguity and L2 Proficiency

A Pearson correlation coefficient was computed to determine the strength and direction of the relationship between the ambiguity types for lexically and phonologically investigated words and L2 proficiency. There is a slight to moderately positive relationship between L2 proficiency and some forms of word ambiguity as demonstrated in Table 6 by the correlation analysis results. In this relationship, the higher the L2 proficiency, the better the ambiguity resolution results especially for homophones and polysemy (r=0.57, r=0.23.; p= 0.054, p=0.039).

Table 6. The correlation between types of ambiguity and the L2 proficiency test.

L2 proficiency		
Ambiguity types	**R**	**P value (Sig.)**
Homophones	0.578	0.054
Metaphor	0.310	0.566
Metonymy	0.414	0.016
Polysemy	0.236	0.039
Homonymy	0.275	0.11

4.4. Auditory Technique, Subjective Familiarity and Ambiguity Resolution

This study employed an auditory presentation technique for ambiguous words to help with meaning recognition before visually presenting them. Participants were asked to rate the extent to which this experience was useful in predicting word meanings from 1 (indicating it to a great extent) to 4 (not at all). The answers were varied (to a great extent 15.8%, somewhat 48.8%, very little 27.7% and not at all 7.7%).

Calculating the frequency of non-native responses for each ambiguous word and its meanings provided varying results on the familiarity of each meaning with regard to the subjective familiarity of the lexically ambiguous terms under study. As illustrated in Table 7 (appeared in Appendix A), some words such as position (way, situation) were classified among the familiar and frequently used meanings for at least half of the sample (frequency f=34, f=24 consecutively) whereas foil (fool) and mint (coin) were highly ranked as less frequent and common for a group of non-native speakers. Although some word meanings were less familiar or unfamiliar to students such as chicken (scared), half of the samples were able to predict their meanings correctly as indicated in Table 2.

When the participants were asked about the strategies employed in ambiguity resolution, they referred to different techniques such as trying to deduce the meaning from the main idea of the sentence (25.6%), examining the meaning with neighbouring words (41%), using a selection restriction technique based on their previous knowledge (7.8%) or making predictions based on the relationship between the words used in the sentence (25.6%).

5. DISCUSSION

Disambiguating L2 word ambiguities remains one of the most intensively examined issues among many researchers and language specialists considering the productive nature of languages and the recurrent emergence of new meanings by manipulating existing linguistic resources to describe situations and fulfill language needs. Lexis

plays a central and important role in L2 vocabulary learning and has a functional load for non-native L2 users (James, 1998). We were interested in examining lexical ambiguity processing, namely polysemous (metaphors, metonymies and homonyms) and phonological ambiguity processing (homophones). According to the current results, non-native English speakers were able to predict the most ambiguous word meanings regardless of variations based on the type of ambiguity and statistical data from the study. This indicates that most lexical and phonological word ambiguities did not pose a significant challenge to this group of participants.

The results revealed that phonological ambiguities were the least challenging of those investigated except for sum/some and scene/seen which were considered challenging for most of them. In this case, additional linguistic clues may be helpful for this type of ambiguity. Polysemous words, particularly metonymous words (described as highly overlapping in meaning) were not a source of difficulty for them since participants were able to predict their intended dominant and subordinate meanings. The most challenging type was homonymous words (with a low overlap in meaning) for both dominant and subordinate meanings. There was support for a case of meaning recognition failure when dealing with subordinate meanings of words such as toll, foil and mint. As Klepousniotou et al. (2012) verified, homonymous words require a longer time in the activation process regardless of the context because they have several unrelated meanings and have distinct representations in the "mental lexicon" and the choice of the appropriate intended meaning is selected from a pre-existing list of senses. Polysemous words (particularly metonymical polysemy) are processed faster indicating that one mental representation is available for the essential word sense and that their related meanings are not competing like homonymous words. Polysemous words have rich semantic representations and senses which facilitate meaning recognition and comprehension compared to the unrelated meanings of homonymous words which exhibit different recognition and comprehension patterns. In the present study, these results are suggested to be consistent with the claims of the generative lexicon model in which the type of ambiguity that intended words present (either polysemy or homonymy) are stored differently determines the lexical access and processing system. Additionally, the nonnative sample easily recognized words with a single representation in mind and a basic meaning value, leading to activation of the appropriate-related meaning in context in contrast to those having separate representations in the mental lexicon which demonstrated different processing patterns.

A slightly surprising and attention grabbing finding was that participants managed to predict some subordinate (less common) meanings of words in higher percentages rather than dominant meanings for the same word regardless of the ambiguity type. For example, the subordinate meanings of the homonymous words park (vehicle), story (floor), tank (military) and the polysemous words spice (thrill) and position (situation) were predicted. One possible explanation for this finding is the role of the context in which each word is placed. The role of interactive processing of sentences in reaching context-intended meaning reported in previous literature especially for non-native speakers (e.g., Almajdoa, 2016; Iravani & Ghasemi, 2012) is supported by the current findings. The co-occurring words that surround a word with a different meaning create a local context that helps the reader completely understand and appreciate the meaning of the term within the sentence (Ovu, 2011). Similarly, the representation or role of local and sentential contexts as identified by Dash (2008) plays an important role in resolving multiple-word meaning ambiguities.

L2 users normally have different L2 acquisition experiences in the same language than monolinguals. English is one of the most widely spoken and researched languages in the world. Currently, there are more opportunities for exposure to English in foreign language learning contexts through social media platforms and Internet applications than in English-speaking countries. The mastery of English by L2 users makes a significant difference in their future professional aspects of life. This study aimed to determine whether advanced non-native English speakers process ambiguous English words in a manner similar to that of native English speakers. It was assumed that native and advanced non-native English speakers would employ the same cognitive mechanisms to predict ambiguous words and have similar English word recognition processing techniques.

Contrary to the expected assumption, the findings revealed evidence of a comparable difference between the English monolingual and English bilingual groups. Native speakers exhibited different performance levels and outperformed the non-native group while responding to phonological and lexical ambiguity resolution tasks except in the case of polysemous metonymy where the results demonstrated no difference between them. The least difference gap in M scores for the two groups was in homophone ambiguity resolution considering a previously mentioned result regarding the difficulty in distinguishing between two similarly pronounced pairs. Native English speakers use different cognitive mechanisms for word meaning recognition and accessibility to lexicon mental representations compared to non-native speakers. These findings provide proof and support for the selective access model (Kellas & Vu, 1999) in which the appropriate meanings of ambiguous words are only activated in each context for native English speakers. In contrast, the responses of non-native English speakers provided support for the graded salience model (Giora, 2003) by demonstrating that more salient meanings in language users' minds are retrieved and activated faster than less salient meanings regardless of the supportive contextual information. However, the saliency of the coded meanings depends on factors such as frequency, conventionality and familiarity. Therefore, there are individual differences in word recognition and comprehension based on meaning dominance and familiarity. It is then presumed that the non-native speaker group might have access to both appropriate and inappropriate meanings in each context according to the reordered access model (Kellas & Vu, 1999) given that they failed to perform as native speakers in disambiguating lexical word ambiguities and extra referential contextual information was required to reach the intended meaning. These findings contradict those found by Almajdoa (2016) in which the L2 non-native sample studied in the American context employed selective lexical access to the meanings of ambiguous words and there were no differences between native and non-native groups according to meaning dominance or ambiguity type.

Another note-worthy finding when differences were measured according to word meaning dominance was that differences were significant in the case of polysemous subordinate words and homonymous words with both dominant and subordinate meanings. These differences exclude polysemous and dominant meanings. It was discovered that polysemous words were easier for the non-native speaker group to recognize than homonymous terms because polysemy as opposed to homonymy is associated with multiple-meaning words that share the same sense. As discussed previously in most studies (see for example Abdurrahman and Jawad, 2019) it is likely that the most dominant and familiar meanings of a multiple-meaning word represented and stored within the mental lexicon are accessed first in an ambiguous linguistic context where an interpretation of meaning is required.

The study also addressed factors that might enhance or hinder ambiguity resolution for non-native speakers such as L2 proficiency and L2 word meaning familiarity. The results concerning the L2 proficiency of non-native English speakers and ambiguity resolution showed that there was a small and moderate positive effect on homophones and metonymical polysemous words, while there was no effect of L2 proficiency on some types of lexical ambiguities (homonymous words and metaphorical polysemous words). This result supports the previously stated finding that the non-native group easily managed to resolve these types of ambiguities. Thus, L2 proficiency was not a determinant of ambiguity resolution although it played an assistive role in some types of ambiguity resolution. However, there was some agreement with Alnamer's (2017) study in which proficiency level played a vital role in predicting polysemous word meanings. Another factor explored in the current study was familiarity with word meanings. Although the intended meaning for most examined words was predicted either by the context effect or the meaning dominance role, the familiarity of word meanings was suggested to give indications about L2 competence in general and vocabulary knowledge in particular. The study also indicated that participants were aware of most meanings which also indicate that they are frequently used. However, they also revealed their ignorance of some of the meanings of these commonly used words. We should be more cautious in interpreting these results considering that familiarity with a particular meaning differs between participants and this factor should be more controlled for future research. The analysis of non-native English group responses indicated that

those groups of L2 advanced users make use of different strategies that guide them in predicting the meanings of multiple-meaning words and revealing their intended meaning in each context concerning ambiguity resolution strategies. The participants in this study mainly relied on three techniques identified by Rajendran and Vidyapeetham (2014): neighbouring words, using word relation restrictions and the main theme or idea in the sentential context. Similarly, Krimat and Friekh (2022) employed themes and selection restrictions for ambiguity resolution. Another attention grabbing technique noticed in non-native speakers' responses was the use of their L1 to guess the L2 meaning. This may be ascribed to the considerable to some degree effect of L1 equivalent lexical structures (Alkhathlan, 2007). Some of the current samples used L1 while interpreting L2 word meanings, a strategy that they employed when they were unable to reach the intended meaning in L2 considering that bilingual users have the advantage of accessing two language systems. Iravani and Ghasemi (2012) also found evidence of L1 interference influencing L2 word access. It was concluded that more research is needed to reflect on the effect of L1 transfer on L2 lexical representation and processing among non-native speakers. Another noteworthy finding was that the auditory presentation technique triggered faster word recognition by hearing words first followed by the eye-tracking technique by reading them. It was assumed that this would enhance participants' ambiguity resolution experience. The participants' self-reported evaluation of employing this technique was to some extent good despite the fact that it was used in an assistive function and that its direct influence on word recognition and accessibility was not examined. Almost half of the participants maintained that it was somewhat helpful to place the word in its context and try to predict its meaning by hearing the words and imagining their meanings before visually looking at them. This finding is consistent with Wang et al. (2020) who stated that exposure to auditory stimuli helps the word recognition process given that the hearer tries to match spoken input with their mental representation of intended words to select the most appropriate word among all activated choices. This study comprehensively examined English word ambiguity resolution processes and techniques among two groups of participants as well as other factors such as L2 proficiency and word familiarity that impact resolution processes. These findings draw attention to the differences between monolinguals and bilinguals regardless of their language proficiency. The higher the L2 proficiency level, the better the users' performance. The bilingual results should be thoughtfully interpreted considering that they access two different language representation systems that might facilitate or hinder the L2 learning experience. Factors such as L1 interference and learning context are used to model and shape this experience.

6. CONCLUSION

The current study used two subject groups (native and non-native English speakers) to examine lexical and phonological ambiguous word processing. The study investigated the effects of L2 proficiency and L2 word familiarity on the ambiguity-resolution process. Techniques employed by non-native samples to assist in ambiguity resolution were also explored. The results revealed significant differences between the two groups in terms of homophone use, metaphorical polysemy and homonym ambiguity resolution. For the non-native group, homophones and polysemy were the least problematic and challenging lexical ambiguity types unlike homonymy. Other results also revealed positive effects of L2 proficiency and word familiarity.

The current study included a limited number of native and non-native English speakers. Conducting a study with a larger number of English users in both groups might reveal more interesting findings. The influence of the speaker's speech or style on L2 ambiguity-resolution processing should be measured to reveal its effect on L2 non-native speakers. This study has important implications considering the vital role of vocabulary in L2 competence and knowledge. L2 users especially learners should be more aware of the multiple meanings of English words and should employ them in different contexts to have faster and full accessibility to the different meanings of any word. In this rapidly changing and developing world, high L2 proficiency is a demanding requirement for L2 mastery especially in non-native learning contexts.

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Appendix A

Table 7. The frequencies of familiarity of lexical ambiguous words meanings.

Meaning	Very familiar	Familiar	Less familiar	Unfamiliar
Polysemy metaphor				
Way	22	12	1	0
Situation	15	9	7	4
Wrist	17	11	2	5
Couch	25	4	2	3
Throat	13	11	7	4
Narrow	19	9	4	3
Laces	14	9	8	4
Lick	12	5	12	6
Hen	20	5	5	5
Scared	7	10	7	11
Universe	15	6	13	1
Famous	23	10	1	1
Thrill	12	13	8	2
Herb	13	9	5	8

Meaning	Very familiar	Familiar	Less familiar	Unfamiliar
Stone	13	3	10	9
Unique	7	10	8	10
Column	7	12	10	6
Model	7	12	4	12
Polysemy metonymy				
People	6	12	7	10
Area inside the head	11	8	7	9
Part of vehicle	15	8	8	4
Clothes	11	9	5	10
Car	17	5	4	9
Round flat object	11	9	5	10
Representative	17	11	2	5
Sound	17	13	1	4
Luggage	18	5	8	4
Garbage	20	6	2	7
Weave	22	4	5	4
Laundry	15	10	8	2
Stadium	18	5	9	3
Concert	12	9	6	8
Crystal	8	9	9	9
Juice	14	10	7	4
Metal	17	12	5	1
Animals	7	13	9	6
Tree	13	10	2	10
Smell	14	6	7	8
Homonymy				
Vehicle	9	9	9	8
Bench	14	7	9	5
Silver	9	10	7	9
Fool	8	6	8	13
Fee	4	10	9	12
Bell	6	11	9	9
Branch	3	10	8	14
Fish	4	16	5	10
Candy	4	10	11	10
Coin	8	7	9	11
Musicians	6	12	8	9
Rubber band	11	8	12	4
Season	13	11	7	4
Water source	14	14	5	2
Feeling	10	13	7	5
Meaning	14	8	10	3
A tale	13	8	7	7
A floor	16	10	6	3
A container	17	12	5	1
A military vehicle	16	11	7	1