When Arabic speakers read English words

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Abstract
Despite the widespread consensus among researchers that readers whose first language is Arabic frequently experience major difficulties with word recognition when reading in English, there is little research into the strategic behaviour of first language (L1) Arabic readers when encountering unknown vocabulary in texts written in English. This paper reports a study designed to contribute to our understanding of the types of reading strategy employed by L1 Arabic speakers when reading in English and in particular the types of knowledge sources and contextual clues they rely on when encountering unfamiliar English words. The following research questions were addressed: 1. What are the principle lexical processing strategies employed by Arabic-speaking university students when encountering unfamiliar vocabulary in academic English texts? 2. To what extent does the employment of these lexical processing strategies result in successful identification of the meaning of unfamiliar vocabulary? A pre-test was conducted to provide a measure of the participants' overall reading proficiency and to ensure the unfamiliarity of the target words. Subsequently, individual reading tasks with concurrent think-aloud sessions were conducted to enable the identification of lexical processing strategies. Two main findings emerged: first, the participants in this study made use of three strategies when dealing with unfamiliar vocabulary; second, these strategies were frequently employed in a noticeably ineffective manner and, in consequence, many of the participants' attempts at inferencing were conspicuously unsuccessful. The pedagogical implications of these findings are briefly discussed.
Keywords Arabic-speakers, lexical processing strategies, L2 English reading, think-aloud protocol

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It is widely accepted that success in reading in a second language (L2) is related to frequent and varied use of reading strategies (Afflerbach, Pearson, & Paris, 2008; Mokhtari & Reichard, 2004; Sheorey & Mokhtari, 2001) and that a common characteristic of the most successful L2 readers is an awareness of and capacity to effectively employ a range of strategies in order to facilitate and enhance reading comprehension (Baker, 2002; Erler & Finkbainer, 2007; Pressley, 2002; Pressley & Gaskins, 2006).

Although reading strategy research is a firmly established field within the second language acquisition research community, there have been few studies conducted with L2 readers whose first language is Arabic. This is surprising given the widespread consensus that Arabic speakers often experience difficulties when reading in English, especially with regard to word recognition (e.g., Endley, 2016; Hayes-Harb, 2006; Ryan & Meara, 1991). Partially replicating Paribakht and Wesche (1999), the study reported here was designed to contribute to our understanding of the types of reading strategy employed by L1 Arabic speakers when reading in English and in particular the types of knowledge sources and contextual clues they rely on when encountering unfamiliar English words.

Literature Review
Investigations of Arabic-speakers as English readers has tended to focus on two key questions: (a) What are the key challenges faced by Arabic-speakers when reading in English? and (b) What kinds of strategic behavior do Arabic-speakers engage in to overcome these challenges?

A small number of studies have investigated the challenges that L1 Arabic speakers face when reading in English. One issue that has attracted some attention is the difficulties Arabic-speaking readers of English appear to experience with relatively low-level processes, such as letter and word identification, that underpin higher level reading processes. A working hypothesis shared by various researchers is that these difficulties are related to "L1-L2 orthographic distance" (Barcroft, 2015, p. 73); that is, that the difference in the orthographic representation of Arabic and English renders recognition of English lexical items especially problematic for readers whose first language is Arabic. This section provides a brief summary of some of the more salient findings.

In a relatively early investigation, Ryan and Meara (1991) refer to the tendency for Arabic-speaking learners of English to produce errors that are "more dramatic and outlandish" (p. 531) than those produced by speakers of other L1s. Ryan and Meara's study took the form of a modified word-matching task involving 100 high frequency 10-letter words. Initially all of the words presented to the participants were correctly spelled. After a short delay the words were presented again. In the second presentation 40% of the items were spelled correctly whereas in the other 60% of cases a vowel had been removed. The task faced by the participants was simple: for each word they had to decide whether or not the two presentations were identical. Three groups of participants were tested: 10 L1 Arabic speakers of lower intermediate to intermediate English proficiency; 10 non-Arabic speakers of comparable proficiency; and 10 adult native speakers of English. Ryan and Meara report that the Arabic-speaking participants were both less accurate and slower in performing this task than the other non-natives and the native-speaking control group. They

interpret this finding as providing "very strong support for the view that Arabic speakers have great difficulty in processing English words" (p. 538).

Similar conclusions have been reached by other researchers. For example, Fender (2003) investigated the performance of two groups of English learners of comparable proficiency on a lexical decision task. One group consisted of native speakers of Arabic; the other comprised native speakers of Japanese. (There was also a control group of English native speakers). The participants were presented with strings of letters. Their task was to decide whether or not a string formed a word. Fender reports that the Arabic speakers were significantly slower and less accurate in their performance of this task than were Japanese speakers when the words were presented in isolation. However, this disadvantage was not apparent when the words were presented in sentence context and, in fact, the Arabic-speaking participants were significantly more accurate in integrating words into larger phrase and clause units and comprehending them than the Japanese-speakers.

In a subsequent study, Fender (2008) investigated the relationship between spelling knowledge and general language processing and comprehension skills (i.e., listening and reading) among two groups: a group of intermediate-level Arab learners of English and a group of non-Arabic learners of comparable proficiency. Fender found that the Arab group slightly outperformed the non-Arab group in the listening test; however, the non-Arab group greatly outperformed the Arab group in both the reading test and the spelling test.

Hayes-Harb (2006) presents evidence from two experiments. Both were designed to test the general hypothesis that "native speakers of Arabic transfer word identification strategies from Arabic to English reading" (p. 325) and, more specifically, that

> native Arabic speakers' pattern of attention to vowel and consonant letters will differ from the other native language groups and that the difference will reflect the relative prominence of consonants compared to vowels in native Arabic speakers' written word identification strategies (p. 325).

As with Ryan and Meara, the participants in Hayes-Harb's (2006) experiments comprised three groups: 10 native Arabic speakers of intermediate English proficiency, 10 non-native intermediate-level English learners from different L1 backgrounds and 10 native speakers of English. Hayes-Harb's first experiment was a modified replication of Ryan and Meara's earlier work. The main modification Hayes-Harb introduced was to include an additional condition in which consonants were deleted to serve as a control. The second experiment took the form of a letter-detection task in which participants were asked to identify all instances of a target letter while reading a text for comprehension. Hayes-Harb reports that Experiment 2 (but not Experiment 1) supported the above hypothesis insofar as a higher rate of vowel detection errors relative to consonants appeared to be specific to the Arabic-speakers.

A few studies have sought to investigate the specific kinds of strategic behavior engaged in by Arabic-speaking readers when reading in English. Shmais (2002) reports a mixed methods study, including a think-aloud, interviews, a multiple choice comprehension test and a questionnaire. The participants, two English majors at a Palestinian university, were both "very good learners of English" (p. 637). According to the researcher, both made use of a range of

strategies during their reading, including repetition, translating, paraphrasing and questioning. Shmais notes, however, that their use of strategies was "haphazard, and limited" (p. 648). This was confirmed by the participants' responses to the comprehension test, which suggested that they had not successfully understood the texts they read. Thus, Shmais concluded that even "good" learners are not necessarily good and proficient readers (p. 648).

A similar conclusion is reached by Abbott (2010), who reports a study in which a think-aloud procedure was employed to investigate the strategies used by two groups of participants while taking a reading test. The two groups were made up of L1 Arabic and L1 Mandarin speakers. All were intermediate level English as a second language (ESL) learners. According to Abbott, the Arabic-speakers made considerably more use of "top-down" strategies such as skimming for gist, linking information presented in various parts of the text, and using background knowledge to speculate beyond the text than did the Mandarin-speakers. Nonetheless, the extent to which these strategies were used effectively was open to question. As with Shmais, Abbott reports that there was a tendency for these strategies to be over-used (especially reliance on background knowledge). She suggests that "successful" reading is not directly related to frequency of strategy use but to appropriate selection and use of strategies.

A few recent studies of the strategic behavior of Arabic-speakers have employed self-reports, most often using the Survey of Reading Strategies (SORS) developed by Mokhtari and Sheorey (2002)[1]. A common pattern to emerge from several of these studies is the tendency for Arabic-speaking subjects to favor so-called "problem-solving" strategies, defined as "localized, focused techniques used when problems develop in understanding textual information" (Mokhtari & Sheorey, 2002, p. 4). Examples of such strategies are: adjusting one's reading speed if the material becomes more difficult (or easy), guessing the meaning of unfamiliar words or phrases from context, and rereading the text to improve comprehension[2].

Mokhtari and Reichard (2004) made use of the SORS instrument to compare reading strategies used by L1 English speakers and L1 Arabic-speakers while reading in English. Information concerning the language proficiency of the participants is not given. Nonetheless, the researchers note that all the participants were attending college and so could be regarded as having achieved comparable levels of education. A key finding to emerge was that all the participants reported awareness of reading strategies, and that there was a tendency to favor problem-solving strategies. As we shall see, this tendency reappears in several other SORS-based studies involving Arabic-speakers[3].

The participants investigated by Malcolm (2009) were students studying medicine in Bahrain, from various countries of the Middle East. Again, the study took the form of a self-report, using the SORS instrument. Based on English proficiency, Malcolm divided her participants into two groups. As with Mokhtari and Reichard above, Malcolm reports that both groups showed high levels of awareness and use of strategies. Again, Malcolm also found a clear tendency to favor problem-solving strategies rather than global and support strategies.

Another study of L1 Arabic-speakers making use of SORS is Alsheikh and Mokhtari (2011). The participants were "advanced proficiency ESL readers" (Alsheikh & Mokhtari, 2011, p. 151). The SORS data indicated that the participants "used all of the strategies in the SORS" (p.

156) when reading both in Arabic and in English. Perhaps not surprisingly, the participants reported using more problem-solving, as well as support-reading, strategies when reading in English than they did when reading in Arabic. This finding was confirmed by data gathered by means of a think-aloud.

Another study of Arabic-speakers that likewise used SORS is reported by Elhoweris, Alsheikh and Haq (2011). In this case the participants were high school students in the United Arab Emirates (UAE). No details regarding the participants' proficiency is given, but the participants had been identified by their teachers as having learning disabilities. The SORS data indicated that the participants used problem-solving strategies the most, followed by the global and support strategies. It should be noted, however, that think-aloud protocol (TAP) data indicated that the participants actually failed to employ more than half of the strategies included in SORS.

Al-Sobhani (2013) used SORS to conduct a study of English majors at a university in Yemen. All the participants had received approximately ten years of English instruction at school and university. Again Al-Sobhani found that participants were aware of a range of reading strategies with all the SORS strategies being used with "high and moderate frequency" (Al-Sobhani, 2013, p. 130). Once again there was a slight tendency to favor problem-solving strategies over global strategies and support strategies. Al-Sobhani reports that the use of problem-solving as well as that of global strategies correlated with scores in reading skills; however, no correlation was found between reading skills and use of support strategies.

Another study of Arabic-speakers involving the SORS is reported in Alsheikh (2014). The participants were high school students in the UAE. Once again, no details regarding the participants' proficiency is given. As with Alsheikh and Mokhtari (2011), the study compared the participants' use of strategies in their L1 Arabic and in L2 English. Unlike the earlier study, however, Alsheikh reports the participants used more strategies when reading in Arabic than in English.

Recently, Endley (2015) also reported a SORS-based investigation of the awareness and use of reading strategies among Arabic-speaking undergraduates at a major university in the UAE. The participants were students majoring in three separate colleges: Business and Economics, Engineering and Humanities and Social Sciences. The results were consistent with those found in several of the studies already noted: first, participants from all three colleges had a high level of awareness of reading strategies; second, there was a general preference for using problem-solving strategies rather than global strategies or support strategies.

A follow-up study (Endley 2016) investigated the reading strategies actually used by twelve Arabic-speaking undergraduates in the UAE when reading texts in English. The procedure employed was a think-aloud protocol followed by a semi-structured interview. Endley reports that both higher-proficiency and lower-proficiency readers were already in possession of a repertoire of strategies, but that they often failed to use them effectively. This was especially the case with the lower-proficiency readers. As we have seen, this finding is consistent with those reported by Shmais (2002) and Abbott (2010).

To sum up so far, based on self-reporting, researchers have found that Arabic-speakers

possess an awareness of and a willingness to use a range of reading strategies when reading in English (e.g., Alsheikh & Mokhtari, 2011; Al-Sobhani, 2013; Endley, 2015). A second common finding is that Arabic-speakers tend to display a preference for so-called "problem-solving" strategies such as adjusting reading speed, guessing meanings and rereading (e.g. Alsheikh & Mokhtari, 2011; Al-Sobhani, 2013; Elhoweris, Alsheikh & Haq, 2011; Endley, 2015; Malcolm, 2009; Mokhtari & Reichard, 2004). At the same time, some researchers have found that often the strategies that Arabic-speakers choose to use are employed in a markedly ineffective manner (e.g., Abbott, 2010; Endley, 2016; Shmais, 2002).

In reviewing the research on Arabic-speakers as readers of L2 English, one other study merits more detailed discussion. The study is noteworthy both for its design and for the findings that emerged. Paribakht and Wesche (1999) report a cross-linguistic study involving 10 intermediate-level ESL students in a university setting. The participants came from a variety of L1 backgrounds, including Arabic. A think-aloud procedure was used to investigate the behavior of the participants when faced specifically with unfamiliar English vocabulary. An initial pretest was conducted in which the participants read a text in English and circled any words they did not know. Several weeks later, individual reading sessions were conducted, comprising think-aloud protocols. The reading session involved two comprehension tasks—a question task and a summary task. The question task required the participants to answer questions based on the text, while continuing to think aloud. Following each question, they were asked if they had encountered unfamiliar words while doing the task and, if so, how they had dealt with each of them. (Paribakht and Wesche refer to this as an "immediate retrospective protocol"). The summary task required the participants to pause in their reading at the end of each paragraph to give a summary of its content. Again, they were asked to verbalize their thoughts while completing this task. Once more, after summarizing each paragraph, they were asked to indicate if they had encountered unknown words and how they had dealt with each word. Following each reading session, informal discussions took place. The discussions focused on the participants' responses to and handling of the vocabulary in the text.

A number of key findings emerged from Paribakht and Wesche's (1999) analysis of their data. First, they report that way in the participants responded to the vocabulary differed depending on the task in which they were engaged. Collectively, they identified an average of 10.6 words as unknown in the pretest, 15.2 in the summary task and 9.3 in the question task. Thus, "the summary task . . . appears to have generally made more unfamiliar words salient to these L2 readers than did the pretest or question task" (pp. 203 – 204). Second, in completing the question task and the summary task, the participants disregarded "approximately half" (p. 204) the words they previously identified as unknown during the pretest. Third, Paribakht and Wesche found that their participants used three distinct strategies in dealing with unfamiliar vocabulary in the text: "attempts at word retrieval", "appeals for assistance" and, most importantly, "inferencing", with the last-mentioned strategy comprising a number of subtypes. They observe that:

> For these advanced learners in a university setting, sentence-level grammatical knowledge was the type of knowledge most often used in lexical inferencing . . . which suggests the importance of such knowledge in lexical processing for learners and conditions such as those in the study (p. 214)

In addition, other important knowledge sources were "word morphology, punctuation, and world knowledge" (p. 214). Finally, Paribakht and Wesche comment that "in spite of the overall patterns", "there were notable individual differences in the knowledge sources used. These differences appeared to be related to individuals' previous L2 learning experience, their L1[4], and their familiarity with the text topic" (p. 214).

Research Questions
Despite the widespread consensus that Arabic speakers experience difficulties with word recognition when reading in English (e.g., Endley, 2016; Hayes-Harb, 2006; Ryan & Meara, 1991), there has been surprisingly little research into strategic behavior of L1 Arabic speakers when encountering unknown lexical items in texts written in English. This paper reports a study designed to address this gap. Specifically, it focused on the following two research questions:

1. What are the principle lexical processing strategies employed by Arabic-speaking university students when encountering unfamiliar vocabulary in academic English texts?

2. To what extent does the employment of these lexical processing strategies result in successful identification of the meaning of unfamiliar vocabulary?

Methodology
The text used for the reading task was selected from an IELTS practice exam. The chosen text dealt with the topic "Light Pollution", which it was hoped would be of general interest and relevance to all the participants. It consisted of 45 sentences, which were divided into 10 paragraphs. The total word count was 913, with an average sentence length of 20 words. The total number of words in the text (i.e., word tokens) was 848; there were 429 different lexical items (i.e., word types). Of the word tokens, 73% were content words (nouns, verbs, adjectives and adverbs); the remaining 27% were function words (prepositions, determiners, conjunctions etc.). The text had a Flesch Reading Ease Rating of 60.5 and was ranked as Flesch-Kinkaid Level 9.9. Thus, it was anticipated that while falling within their general reading level, the text would present the participants with a comprehension challenge, and so elicit reading strategies.

The study involved several stages:

Stage 1. Identification of unfamiliar lexical items.

Stage 2. Vocabulary knowledge scale.

Stage 3. Reading task with concurrent think-aloud protocol.

Stage 4. Semi-structured interview.

These stages require further comment. As with Paribakht and Wesche (1999), the identification of unfamiliar vocabulary (Stage 1) was conducted by having participants read the text and mark any words that they either did not know or were unsure about. Collectively, the participants identified 77 word tokens as unknown/unfamiliar. From the words thus identified, 15 were randomly chosen to comprise the target words for the remainder of the study.

To further investigate participants' knowledge of these words, a version of the Vocabulary Knowledge Scale (VKS), developed by Wesche and Paribakht (1996), was administered (Stage 2) one week later. The VKS is a widely used instrument designed to measure receptive and productive knowledge of targeted lexical items from L2 reading. The rationale for administering the VKS was to gain more detailed information regarding the depth of knowledge possessed by the participants for the target words. In the version used here, participants were presented with 15 target words and asked to rank each word using the following scale: 1. I don't remember having seen this word before; 2. I have seen this word before but I don't know what it means; 3. I know this word; it means . . .; 4. I know this word and I can use it in a sentence.

For each word that she ranked 3, the participant was required to write the word and the meaning she thought it had on the line provided. For each word she ranked 4, the participant was asked to write a sentence containing the word.

The reading task (Stage 3) involved a think-aloud protocol (TAP). In a TAP, participants are required to provide "an ongoing report of his or her thought processes while performing some task" (Mackey & Gass, 2005, p. 77). While the validity of this procedure has been much discussed (Bowles, 2010; Konieczna, 2011; Leow & Morgan-Short, 2004; Morgan-Short, Heil, Botero-Moriarty & Ebert, 2012; Yoshida, 2008), it is generally accepted that, TAPs can provide "rich data concerning the flow of information through working memory . . . without intruding significantly on the comprehension process itself" (Yoshida, 2008, p. 207). TAPs may be concurrent (i.e., the participant articulates his/her thought process while engaged in a reading activity) or retrospective (i.e., the participant recalls her thought processes after completing the reading). It is generally agreed that concurrent TAPs are to be preferred. Again, TAPs may be metalinguistic (i.e., the participant attempts some explanation of his/her thought processes) or non-metalinguistic (i.e., the participant simply reports without explanation). The current study involved a concurrent non-metalinguistic TAP.

Each reading session was conducted on an individual basis. The sessions took place in the Department of Linguistics Phonetic Laboratory at United Arab Emirates University (UAEU). At the beginning of the session the purpose of the study was explained, together with the underlying rationale of think-aloud research. Participants were also invited to ask questions prior to beginning of the session. The researcher did not model the think-aloud process on the grounds that such modeling might bias the participants' subsequent behavior (Pressley & Afflerbach, 1995)[5]. However, prior to beginning to record, participants were given a picture description task to accustom them to verbalizing their thoughts. Following this, participants were reminded to pay particular attention to vocabulary as they read and that they should verbalize all their thoughts, in English, while reading. They were told that they were free to consult a dictionary, and that they were allowed to mark the paper. They were also told that they would be asked to summarize their understanding of the text after completing each paragraph. The rationale for including a spoken summary was that it would necessitate greater mental effort to understand the target items than would be the case from a passive reading of the text, which might result in only a minimal level of lexical processing. There was no time limit set for completion of the reading.

Once the participant indicated that she was ready, the recorder was switched on and the reading session began. The researcher remained in the Laboratory during TAP sessions, seated

behind the participant, observing and taking notes for use in the follow-up interview. Researcher intervention was kept to a minimum; however, occasional verbal prompts (e.g., "What makes you think that?" and "Please keep talking") were used.

The semi-structured interviews (Stage 4) were also recorded. The purpose of the interviews was to clarify the participant's thought processes while reading and to explore in greater depth their handling of the target words.

Setting/Participants

The study was conducted at UAEU, a major university in the Gulf region, and the national university of United Arab Emirates. Established in 1976, UAEU consists of nine colleges, each of which is subdivided into several departments. The language of instruction is English. The student population is predominantly made up of UAE nationals (circa 95%). The university is gender-segregated, with an internal 70/30% female/male demographic.

The participants were female Arabic undergraduates (*n*=10), all L1 Arabic speakers, aged from 19 – 21 years. They were selected by means of nonrandom purposive sampling from a range of colleges and were majoring in a range of academic disciplines, including biochemistry, chemical engineering, chemistry, finance, political science, translation, and veterinary medicine). In order to enter the college of their choice, UAEU students are required to pass an IELTS exam. The participants' IELTS scores ranged from Bands 5 to 6.

Results

Analysis of VKS data

Participants initially identified 77 words as unknown or unfamiliar, all of them content words[6]. Of these, 15 were randomly selected as the target words for the remainder of the study. The following table presents participants' responses to each of the target words presented in the VKS:

Table 1. *Individual responses to target words presented in VKS*

TARGET	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	AVG.
ADVOCATE	3	3	1	2	2	4	2	1	2	3	2.3
CADRE	3	1	1	4	4	4	2	1	3	3	2.7
DAZZLE	2	3	1	2	3	4	4	4	4	2	2.9
EMANATING	3	4	4	2	1	4	2	1	2	3	2.7
EMPHATIC	2	1	1	2	4	4	1	2	4	2	2.3
FATALLY	1	3	1	2	3	4	1	3	4	1	2.3
GLARING	3	4	1	2	2	4	4	3	4	3	3.0
HAZARD	4	4	4	4	4	4	4	2	4	4	3.8
HAZY	3	2	4	3	3	4	4	2	4	2	2.9

ILLUMINATES	3	2	4	3	3	4	4	4	2	3	3.2
LEGISLATION	3	3	1	4	3	4	1	1	1	3	2.4
NORMS	2	2	3	3	4	4	2	2	4	2	2.8
SUBURBS	3	4	1	2	3	4	1	2	2	3	2.5
TESTIMONY	3	4	1	3	3	4	1	1	3	3	2.6
TRESPASSING	2	2	1	2	3	4	2	1	1	2	2.0
TOTALS	40	42	29	40	45	60	35	30	44	39	

Key: 1. I don't remember having seen this word before; 2. I have seen this word before but I don't know what it means; 3. I know this word; it means . . .; 4. I know this word and I can use it in a sentence.

As the data in table 1 shows, the participants' responses to the target words presented in the VKS were quite varied. The average ranking for individual words ranged from a high of 3.8 out of 4 (*hazard*), with all but one participant claiming that they knew the word and could use it in a sentence, to a low of 2.0 out of 4 (*trespassing*). In terms of individual responses, one participant, (P6), claimed to know and be able to use all 15 target words; the sentences she produced to illustrate her knowledge did indeed indicate familiarity with all the words. This individual should be seen as an outlier. No other participant displayed the same depth of vocabulary knowledge. Most participants accorded several of the words a rank of 1 or 2. In fact, P3 accorded no less than 10 of the target words a ranking of 1, indicating that she did not recognize the item at all.

Closer analysis of the responses to the VKS reveals a more nuanced picture. Consider first of all some of those words ranked as 3, a ranking that means the participant believed she knew the word and could provide a synonym or an explanation. In some cases, the participant was able to provide a synonym or explanation that was acceptable:

Example 1. **Hazy**: Foggy, cloudy, making it hard to see (P2)

Example 2. **Suburbs**: In the city, lots of houses (P5)

Example 3. **Illuminates**: Turn on a light, make it bright (P6)

But consider the following cases:

Example 4. **Cadre**: Make it better (P1)

Example 5. **Fatally**: Slowly with being careful (P5)

In both these cases, the participant offers an inaccurate response, indicating that the word is not genuinely known at all, despite what she had initially claimed.

Turning to those items ranked 4, we again see that in some cases knowledge of the word was in evidence with a participant able to produce an appropriate sentence containing the word in question:

Example 6. **Dazzle**: It's a little bit dazzling here and I cannot see properly (P8)

Here the participant not only has a firm grasp of the meaning of the noun, but has correctly modified it to an adjective. This contrasts with the following instance:

Example 7. **Hazard**: Never play with chemical substance because it is hazard (P1)

Here it seems that although the participant understands the meaning of the target word, her knowledge is only partial since she has failed to use the appropriate part of speech (i.e., *hazardous*).

In other cases, despite according a word a ranking of 4, it was clear that a participant had no understanding of the word at all. Consider the following:

Example 8. **Emphatic**: The emphatic of the presentation was positive (P9)

Analysis of TAP data
Analysis of the TAP data revealed that the participants made use of three main types of strategy. These may be designated as follows: (a) repetition of a target word and/or rereading a phrase or clause containing an unknown word, (b) consulting a dictionary to verify the meaning of an unknown word, and (c) attempting to infer the meaning of a word by means of various linguistic and extra-linguistic cues.

Of these three broad types of strategy, two (repetition/rereading and inferencing) were employed by all participants, albeit with varying degrees of effectiveness. The other strategy, consulting a dictionary, was also very widely used, with all but one participant making some use of this. Illustrations of these various reading strategies, drawn from the transcripts of the TAP sessions, are provided below.

Repetition/Rereading
Paribakht and Wesche (1999) construe strategic behavior of this sort as an attempt at word retrieval. All ten participants made some use of this type of strategy, either by repeating problematic words in isolation, or by rereading phrases and clauses that contained some problematic lexical item. In some cases (but not all) use of this strategy resulted in successful retrieval of the meaning of the word from memory:

Example 9. **Suburbs**: in the suburbs . . . sub [partial repetition] . . . suburbs [repetition] . . . I know this . . . it's . . . I think it related to city or town . . . it's like an area outside the city (P5)

In the above extract, the participant indicates that she has met the target item previously ("I know this"); her repetition enables her to successfully retrieve the meaning of the word from memory.

Consulting a dictionary

Nine out of ten participants sought to verify the meaning of one or more lexical item in a dictionary. The exception was P6 who, as we noted above in discussing the VKS data, apparently knew all the words and was able to use them appropriately. However, as will be discussed below, there was considerable variation with regard to the effectiveness of participants' dictionary use. It is worth noting that for Paribakht and Wesche (1999) looking up a word in a dictionary is one form of a strategy they refer to as "appeal for assistance". The other form is directly asking the researcher for help. In the present study, none of the participants made use of this latter strategy.

Inferencing
Inferencing was the most commonly used strategy among the participants, accounting for almost 90% of strategy use overall. This is strikingly consistent with the findings of Paribakht and Wesche (1999), who reported that inferencing accounted for almost 80% of overall strategy use. In the present study, all ten participants made some use of inferencing (albeit not always successfully). As with Paribakht and Wesche's participants, their efforts at inferencing made use of a range of linguistic knowledge sources and contextual cues, often in combination:

Morphosyntactic knowledge

Phonological clues

Intra-textual evidence

Extra-textual knowledge

All participants made efforts to use morphosyntactic knowledge to infer the meaning of target words, focusing on sentence-level grammatical functions and relationships (lexical category, word order) and word morphology (the presence of derivational or inflectional affixes). Illustrations are given in the following excerpts from the TAP data:

Example 10. **Emphatic**: an emphatic no . . . I don't know this . . . emph [partial repetition] . . . it's an adjective I think because of the an . . but I don't know what it means . . . I've no idea (P3)

In the excerpt above the participant correctly identifies the target word as an adjective (even though the reasoning she employs is not strictly to the point since, obviously, the article 'an' could be followed by a noun rather than an adjective). In any case, her effort to infer the meaning of *emphatic* is conspicuously unsuccessful. She is unable to offer any suggestion with regard to the word's meaning.

In the next two excerpts, we can see participants drawing upon their knowledge of English morphology (the derivational morpheme *-tion* and grammatical inflection *-ing*). Once again, however, in both cases their efforts are unsuccessful:

Example 11. **Legislation**: legis . . legislation . . . ok . . that's a noun because of the ending but I don't know the meaning (P7)

Example 12. **Emanating:** emanating . . . I don't know . . emanating [repetition] . . . I think it must be a verb because of ing . . . I think maybe it's like strong or something (P5)

In the next excerpt the participant uses her morphological knowledge to correctly identify the category of the word, recognizing that the inflectional morpheme *-ing* marks a verb; she then confirms her understanding by considering the syntactic context in which the word is used.

Example 13. **Emanating**: I'm not sure about this word . . . emanating . . . but it's a verb I think because it has ing . . . and . . . it says the light emanating from street lamps . . . so the light comes from the lamps . . . it means comes (P4)

The TAP data also contains examples of inferencing based on a phonological clue rather than morphosyntax. Note the use of expressions such "it sounds like" and "it sounds the same" in the following examples:

Example 14. **Norm**: the norm . . . what is that? . . . I've never seen . . . it sounds like

normal . . . that's what it make me think of . . . maybe . . . it says over-lit shopping mall

parking lots are the norm . . so they're normal . . . I think that's it . . . norm means normal

(P10)

Example 15. **Emphatic**: an emphatic no . . . maybe . . . this is like emphasis . . . it sounds the same . . . when you . . . emphasize . . . that's to make it more clear . . . stronger . . . an emphatic no [repetition] . . . like a strong no . . . is that right? (P1)

The next example is especially noteworthy in that we again see the participant making use of a phonetic similarity between the target word and a word already held in her mental lexicon but, in this case, she draws on her L1 phonological knowledge:

Example 16. **Cadre:** cadre of astronomers . . . cadre [repetition] . . is . . . it sounds like

. . . in Arabic we have kawaadir . . it's a team . . . does that . . . it could be this . . . a team

of astronomers . . . yes that works . . . but it's Arabic not English . . . I'm not sure (P7)

In the interview following the TAP, this participant confirmed that it was the phonetic similarity between the English and Arabic words that stood out for her, alerting her to the possible similarity in meaning.

Another type of inferencing strategy that emerges from the TAP data is the use of intra-textual clues, that is, using information from beyond the immediate sentence boundary to help make sense of some item. A particularly clear example of this is given below:

Example 17. **Legislation:** legislation . . . I think it's related to law because here [pointing to lines above] they talk about passing a law . . . it's like making laws . . . putting rules (P1)

Another type of inferencing strategy, making use of extra-textual knowledge, was much less commonly used, with only two participants explicitly employing it on one occasion each. In the first case below, the participant draws upon her prior knowledge of terminology used in her major (Chemistry) to arrive at a reasonable understanding of the target:

Example 18. **Emanating**: it's like release . . . in chemistry we use this word when heat or energy is released . . . so here the light is emanating from the lamps . . . it's released . . . it's the same (P1)

In the next example the participant recalls hearing the word used in a very different context but again is able to use this to make a reasoned guess as to the meaning of the word in the passage:

Example 19. **Trespassing**: ok I know . . . I've heard this word used . . . when I watched . . . movies . . . trespassing . . . it's like . . going into someone's house . . . not allowed . . . but here it says low-sodium lights that block light from trespassing into unwanted areas . . . it's light that's trespassing . . how is that? . . . I think people . . oh it says unwanted . . . so the light is going into houses and people don't want it . . . it's trespassing in their houses [laughing] . . . I didn't know you could say that (P10)

Discussion
This study was designed to answer the following two research questions:

1. What are the principle lexical processing strategies employed by Arabic-speaking university students when encountering unfamiliar vocabulary in academic English texts?
2. To what extent does the employment of these lexical processing strategies result in successful identification of the meaning of unfamiliar vocabulary?

With regard to the first question, concerning the types of strategy employed, we saw in the previous section that participants used three principle strategies during the reading task: repeating and rereading, consulting a dictionary, and inferencing. The last of these involved participants making use of four types of knowledge: morphosyntactic knowledge, phonological clues, intra-textual evidence and extra-textual (background) knowledge. Overall, the participants showed a marked preference for inferencing, with attempts to infer the meaning of a word accounting for almost 90% of the total number of strategies used. As already noted, this figure is consistent with the findings of the earlier study by Paribakht and Wesche (1999), who reported that inferencing accounted for 80% of their participant's strategy use. The tendency to favor inferencing is likewise consistent with those reported in several of the SORS-based investigations which, as we noted above, found a preference for problem-solving strategies (Alsheikh & Mokhtari, 2011; Al-Sobhani, 2013; Elhoweris, Alsheikh & Haq, 2011; Endley, 2015; Malcolm, 2009; Mokhtari & Reichard, 2004). Dealing with unfamiliar vocabulary is a significant problem that all L2 readers inevitably face. The ability to infer word meanings is one of the central cognitive processes required of "good" L2 readers (Nassaji, 2004; Nation, 2013).

Accordingly, the fact that some of the participants in this study were able to successfully infer the meaning of unfamiliar vocabulary is encouraging. As we have noted, drawing upon their morphosyntax knowledge was the means the participants employed most frequently in their attempts to infer the meaning of unfamiliar vocabulary. This is not entirely surprising. In the interviews, several participants recalled that as high school students of English they had been taught to make use of syntactic and morphological cues when encountering difficult vocabulary. The data gathered here would suggest that most of the participants were aware of the potential usefulness of such cues, even if they were not always able to apply this strategy successfully.

In addition to their knowledge of morphosyntax, some of the participants attempted to use phonological clues, intra-textual evidence and extra-textual knowledge to infer word meanings. Given that use of these cues was less in evidence in the data, further strategy-training might focus on developing such awareness. For example, students might be taught the value of being alert to the sounds of words while reading (i.e., to consider whether a problem word 'sounds like' any other word they already know). Again, texts will invariably contain intra-textual clues that can assist the reader in making sense of a word that they are not sure of. Thus, as L2 readers students might be shown the importance of searching the surrounding text for clues that indicate the meaning of the target word. Contrary to what Abbott (2010) reports with regard to her Arabic-speaking subjects, there was no evidence here that participants were overusing extra-textual (or background) knowledge when reading in English. As already noted, only two participants made explicit use of background knowledge in an effort to figure out the meaning of particular words. Indeed, the findings presented here suggest that students might make greater use of this strategy, being encouraged to think about possible connections between an unfamiliar word and any relevant prior knowledge they have.

The second question focused on the extent to which the use of these various strategies resulted in successful identification of the meaning of unfamiliar vocabulary. In other words, it was concerned with the effectiveness of the participants' strategy use. As we have seen, many of the participants' attempts to use a particular strategy were unsuccessful, or at best only partially successful. This is in line with the findings of several other investigations which have reported a tendency for Arabic-speakers to make ineffective use of strategies (Abbott, 2010; Endley, 2016; Shmais, 2002). Instances of such ineffective use were especially noticeable when a participant relied on knowledge of word morphology as her main strategy. Consider again two of the illustrative examples given above:

Legislation: legis . . legislation . . . ok . . that's a noun because of the ending but I don't know the meaning

Emanating: emanating . . . I don't know . . emanating . . . I think it must be a verb because of ing . . . I think maybe it's like strong or something

In both these cases the participant has used her knowledge of word morphology to correctly identify the lexical category of the target word. However, in neither case has the participant been able to go on to successfully infer the meaning of the item. Identifying the part of speech of an unknown word may be a crucial first step, but reliance on morphology alone can only take one so far and does not automatically result in a correct understanding of word meaning. Examples such those above provide support for the somewhat pessimistic conclusion arrived at by Shmais (2002), namely, that even good L2 learners are not necessarily proficient L2 readers. At the very least, they would seem to indicate the need for more extensive training in how to employ morphological knowledge in combination with other lexical processing strategies.

Other types of strategy were also utilized in a somewhat haphazard manner. This was especially the case with dictionary use. As we have seen, all but one participant (P6) consulted a dictionary for one or more of the target words. Again, however, the extent to which participants used their dictionaries effectively is open to doubt. Successful use of a dictionary as a reading

strategy involves several steps (Nation, 2013), in particular it necessitates being able to identify the most appropriate sub-entry, relating this to the context and deciding whether it makes sense. In most cases was no evidence of an attempt to evaluate different potential meanings of the target word and to consider which meaning was most suitable in the context of the reading passage. Rather, the tendency was apparently to simply accept the first definition found in the dictionary. During interviews, several participants indicated that they consciously kept a dictionary close by when reading in English, and turned to it regularly. Nonetheless, the evidence from the present study is that there is a need for more training in the appropriate use of dictionaries. This finding is consistent with that reported by Endley (2015) in which ineffective dictionary use was reported as a common characteristic of lower-proficiency readers.

Another common tendency noted during the reading sessions was for participants to mark by underlining or circling some of the target words. Where this occurred, it is reasonable to interpret it as evidence that a participant was paying particular attention to the word. It is worth noting that in both the unsuccessful instances of using word morphology above, the participants had first circled the word in question.

Related to this, while underlining and circling words was a common action it was noticeable that when summarizing some of the participants failed to attend to a word they had marked, or simply passed over it with a brief comment such as "I don't know this word" or "I'm not sure about this word". That participants attempted to negotiate the summarizing task without explicitly engaging with problematic vocabulary is especially noteworthy. As noted above, it was anticipated that the requirement to provide a spoken summary would necessitate greater mental effort to understand the target words (i.e., deeper processing) than would be the case from a passive reading of the text, which might result in only minimal lexical processing. Clearly, however, this expectation was only partially fulfilled.

This tendency for learners to disregard some target words, even when asked to summarize their reading, is striking. On being asked about this during the interview, some of the participants explained that they deliberately marked words that "looked important". At the same time, some evidence emerged during the interviews that perception of word difficulty had a bearing on how particular words were treated. Two participants confessed that they chose to ignore a word during the summary because it was "too long" or "looked difficult". Once again, this is consistent with the findings of Paribakht and Wesche (1999) who reported that in their study "avoidance remained a frequent response" (p. 213).

Conclusion

The findings reported above throw further light on the kind of processing that Arabic speakers engage in when reading in English. In particular, they indicate some of the specific strategies such readers employ when encountering unknown or unfamiliar English vocabulary items. The participants in this study made use of three strategies when dealing with unfamiliar vocabulary. These three strategies were repeating and rereading, consulting a dictionary and inferencing. Inferencing was the most commonly used strategy. In their attempts to infer word meanings the participants drew upon a range of knowledge sources and made use of various cues: morphosyntactic knowledge, phonological clues, intra-textual evidence and extra-textual knowledge. At the same time, these strategies were frequently employed in a noticeably ineffective

manner and, in consequence, many of the participants' attempts at inferencing were conspicuously unsuccessful.

Notes

1. This self-report instrument, which has become widely used, is designed specifically to measure the awareness and use of strategies among readers of L2 English. It divides strategies into three subcategories.

2. In addition to problem-solving strategies, there are "global" and "support" strategies. Global strategies are "intentional, carefully planned techniques by which learners monitor or manage their reading" (Mokhtari & Sheorey, 2002, p. 4), such as identifying a clear purpose for reading and maintaining this purpose in mind while reading, previewing the text in terms of length and organization, and making use of typographical aids, tables and figures. Support strategies are "basic support mechanisms" (Mokhtari & Sheorey, 2002, p. 4) such as consulting a dictionary, note-taking, and underlining or highlighting of key words and phrases.

3. There is no suggestion that this tendency is unique to Arabic-speakers. Several studies involving participants with a range of L1 backgrounds have reported the same finding. See, for example, Magogwe, (2013); Tabatabaei & Assari (2011); Temur and Bahar (2011); Yuksel and Yuksel (2012).

4. Unfortunately, Paribakht and Wesche do not pursue this hint, restricting themselves instead to a general discussion of their findings. It would have been interesting to know of any possible correlations between particular L1 backgrounds and the use of specific strategies.

5. The question of whether to provide participants with a model is somewhat contentious. For discussion see Bowles (2010). In the present case, a decision was taken to not provide a model in order to avoid the risk of influencing the participants' choice of strategies.

6. Interestingly, Paribakht and Wesche (1999) also found that the words which their subjects identified as unknown were all content words. The reason for this is, as they suggest, that function words tend to be high frequency, and therefore already somewhat familiar—at least in form—to L2 readers. As a result, they are not identified as unknown.

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