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Recalling Arabic and English Prefixed and Suffixed Verbs among Arabic-English Bilingual Speakers: An Experimental Study in Relation to Working Memory

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Abstract

The current study focuses on how prefixes and suffixes in Arabic and English impact one's working memory capacity to recall verbs. Further, it deals with whether or not Arabic-English bilingual speakers recall Arabic and English prefixed and suffixed verbs differently. To investigate this, the study was conducted in the form of two experiments on a group of 10 graduate students. The first experiment was on Arabic prefixed and suffixed verbs, whereas the second experiment was conducted similarly on English. The study concluded that suffixed Arabic verbs were recalled more than the prefixed ones, whereas in English the result was contrary where the participants could recall prefixed verbs more than the suffixed ones. This shows that L2 (Second Language) does not differ from L1 (First Language) in the effort exerted to recall words. Rather, the findings may suggest that it is easier to recall words in the second language, which might be due to the intensive instruction received in the second language. The study also discovered that several other factors played important roles in making the participants recall the items such as word-length effect, frequency and recency of the words.

Keywords: Arabic-English bilinguals, working memory, recalling verbs, prefixed verbs, suffixed verbs

1. Introduction

1.1 Working Memory Model

Among cognitive psychologists, issues related to Working Memory (WM) have been an important topic for many years. In the last couple of decades, both linguists and Second Language Acquisition (SLA) researchers have also shown a major interest in WM functions as they have endeavored to learn more about the role of memory and information processing in Second Language Acquisition (Wen, Mota, & McNeil, 2015). WM is a system capable of holding and managing new and already stored pieces of transitory information in the mind. WM can encompass such subsystems as storage and manipulation in areas like visual and verbal imaging. In this theoretical framework, WM is tasked to monitor this information, place it or locate it into a workable pattern, i.e. process the data, dispose of the unnecessary information, and retrieve it upon command (Carroll, 2008; Field, 2004).

According to Baddeley and Hitch's original model, WM consists of three parts: the central executive, the phonological loop, which contains phonological store and the articulatory rehearsal mechanism; and the visuospatial sketchpad. Phonological loop and the visuospatial sketchpad are considered to be slave systems of the central executive part. Further, one of the jobs of the central executive is to control attentions and make decisions. It also makes sure that all WM resources are used according to the proper guidelines and used in a manner consistent with achieving the goals that have been adopted (Baddeley & Hitch, 1974; Gleason & Ratner, 1998). The central executive possesses a "limited capacity pool of general processing resources" (Carroll 2008, p. 48).

However, the original model has faced many criticisms in recent years. The critics claim that the original model is not effective in explaining the effects and impacts of long-term information on WM. In other words, it ignores the fact that the stored information that we have about the world and the things surrounding us significantly impact WM. These criticisms have led the author of this model to revise the original model and add another component to it. This component is known as the "episodic buffer" .This component has several features. For example, it is conceptualized as

being linked to long-term memory (LTM) and it also integrates information from the other components which can enable the formation of a coherent experience (Baddeley, 2000).

WM is measured in different ways. One of the oldest and most important tasks to investigate WM is called the *simple span test*. This test was first published by Daneman and Carpenter in 1980. It is based on a research methodology which many investigators also call *the memory span test*. In this test, a number of words or linguistic items are shown to participants who are instructed to remember them in the order in which they were presented. Then, researchers measure the participants' WM based on the number of words or items they can recall. These tests have lead researchers to discover many crucial aspects about WM such as factors that prevent WM from recalling words.

There is a substantial body of research on word recall in relation to WM and how WM processes simple and complex words. Further, many studies have been conducted on prefixed and suffixed words and how they are recalled in WM (Carroll, 2008; Cohen-Mimran, Adwan-Mansour, & Sapir, 2013; Marslen-Wilson & Tyler, 2007; McKinnon, Allen, & Osterhout, 2003; Rastle & Davis, 2008; Service & Maury 2014; Service & Tujulin, 2002;Taft & Forster, 1975; Veinovic, Milin, & Zdravcoic, 2010) . Further, in the past several decades, many studies have been conducted on the relationship between WM and L1 and L2. In recent years, there have been a number of studies addressing whether or not a person who has learned the L1 and then the L2 employing the phonological loop system shows different WM capacity in the two languages. This research has also looked at what factors may possibly cause these differences (Veinovic et al., 2010). However, to the best knowledge of the researchers, no study has been conducted investigating word recall in Arabic and English and whether or not prefixed and suffixed verbs are recalled differently in both languages. This experiment examines whether or not it requires extra efforts on WM to recall words in a second language. The study also focuses on how prefixes and suffixes in Arabic and English affect one's WM performance to recall verbs. Further, it aims to investigate whether prefixed verbs are easier to remember or suffixed ones. The study also attempts to find the techniques utilized in recalling words in both L1 and L2.

The study hypothesizes that recalling words with suffixes is easier than words with prefixes. It has been observed that when people see a word with a prefix, they try to process whether or not the prefix is a part of the word. For example, upon observing the word "irreversible", the participants detach the 'ir' from 'reversible', and then search for the 'reversible' in their memory. This happens theoretically because there are some words starting with 'ir' but the 'ir' is not a prefix. As a result, this makes the participant discover whether the 'ir', 'im', 'in', 'un', etc. are parts of the word or not. Researchers explain that this process places a heavy burden on the participants' WM, and consequently, it takes participants longer to process and recall the word. Sometimes, this process causes the participants to forget the word completely. However, words with suffixes are easier to recall because the participants can easily decide that the base comes before the suffixes. For example, upon observing the word 'teacher, participants can easily decide that 'teach' is the base, and once they find the base, recalling the whole word becomes easier (Carroll, 2008; Cohen-Mimran et al., 2013; Taft & Forster, 1975)

2. Literature Review

2.1 Bilingual and Monolingual Working Memory

In the controversial field of WM, the sub-systems which store and manipulate visual images and verbal information have been studied in great detail. Moreover, numerous corresponding experiments have been designed to test several theories about how memory works and to examine WM capacity on bilingual and monolingual speakers. The studies done on this topic usually address the issue of how bilingual and monolingual memories store, organize, access, and recall words (Baddeley, 2003; Veinovic et al., 2010). In order to investigate the relationship between WM and L1 and L2, researchers have largely investigated the phonological loop and its relation to vocabulary and grammar learning (Baddeley, Gathercole, & Papagno, as cited in Wen et al., 2015, p. 45). Most of the studies that focus on this issue claim that there is a strong relationship between WM and vocabulary, and even grammar acquisition/learning (Gathercole & Baddeley, 1993). Some of the researchers, including baddeley, 2003, claim that phonological WM can be regarded as an important "language learning device". The phonological WM helps learners acquire new phonological forms. Additionally, there are many researchers claiming that in learning L2, WM plays the same role as it does for L1 (Wen et al., 2015). Wen writing in 2012 claims that sometimes the link between WM and SLA are stronger or more durable than the linkages found in connection with WM and L1A. For instance, Keijzer (2013) discusses the results of several WM tests on a variety of bilingual and monolingual speakers. He shows that age definitely has a negative effect on word recall. The study shows that older participants consistently performed more poorly on WM tests than their younger counterparts. In addition, the research shows that subjects proficient in both L1 and L2 scored higher on experiments than speakers of only one language. These results imply that second language learners are better equipped to recall words and have a more active and developed working memory. The findings of Ardila et al., (2000) are different from that of the previous study. For Ardila et al., (2000) early bilinguals do better on WM tasks than their older counterparts who learned L2 later in life. This result is further supported by Majerus, Poncelet, Van der Linden, and Weekes (2008), and Service, Simola, Metsänheimo, and Maury (2002). All of these researchers maintain that accomplished bilinguals have significant WM advantages in comparison with less accomplished bilingual speakers.

2.2 Factors that Have Effects on Working Memory Capacity

For the past several decades, there has been a considerable amount of research into investigating which factors impact WM capacity in both L1 and L2 .These studies have led researchers to find many factors that prevent WM from recalling words (Baddley, Thomson, & Buchanan, 1975; Cohen-Mimran et al., 2013; Rubin, Becker, & Freeman, as

cited in Carrol, 2008, p. 123; Taft & Forster, 1975). One such factor is referred to as the word-length effect. The Word-length factor is shown in a study conducted by Baddeley et al., (1975). In this study, participants are given a list of words containing various numbers of syllables. Some of the words contain one syllable, while others comprise more than one syllable. Then, they are asked to recall the words in the correct order. The study discovers that those words containing only one syllable are more easily remembered than words comprising two or more syllables. The result of this study is further supported by the findings of the study by Campoy (2008) which discovers that those words that comprise four phonemes are recalled easier than those words that comprise six phonemes. However, the findings of some other studies are quite different from that of the aforesaid studies. These other studies show that the word-length-effect is caused by the duration of the words in the memory, not by the number of syllables or by the number of phonemes the items comprise. That is, sometimes words are identical in terms of the number of the syllables but different in terms of duration (Baddeley, Lewis, & Vallar, 1984; Baddeley, 1986; Burgess & Hitch, 1992; Ellis & Hennelly, 1980). For example, Gathercole and Baddeley (1993) discuss a study in their book that supports this finding. The study compares *wicket* and *bishop* with *harpoon* and *Friday*. The first two words are short in duration, whereas the other two are long in duration. All of the words comprise two syllables. The result shows that the first two words are recalled easier than the other two words. This is due to the fact that the first two words are shorter in duration and do not take a long time for WM to recall them.

In addition to the word-length effect, the phonological similarity of words also has an effect on WM performance. In other words, words that are similar in rhythm are more difficult to recall than words that are not rhythmic. This is evidenced in such studies as Baddeley (1966) and Conrad and Hull (1964). The findings of these two studies are further supported by the study of Baddeley, which maintains that similarities in features between two words and/or sounds make it more difficult for the WM to recall the item. In other words, the more features and similarities there are between the to-be-remembered items; the greater the chance there will be of forgetting the items (as cited in Gathercole & Baddeley, 1993, p. 12). However, some researchers claim that phonological similarities may not have any effects on WM performance. This is evidenced in the study done by Copeland and Radvansky (2001). The results in this study demonstrate that similarities between the to-be-remembered items do not prevent WM from being recalled. On the contrary, those words that were similar in sounds and features are recalled more than those that were not.

In addition, in the past several decades, many studies have been conducted on how morphologically complex words are processed and decomposed in the brain (Cohen-Mimran et al., 2013; Marslen-Wilson & Tyler, 2007; McKinnon et al., 2003; Rastle & Davis, 2008; Service & Maury 2014; Service & Tujulin, 2002;Taft & Foster, 1975). These researchers claim that prefixes and suffixes have an effect on WM performance to recall words. In other words, both simple words and complex words are processed in the brain in totally different ways. This is supported in the studies done by Service and Maury (2015), and Service & Tujulin, (2002). These two studies conducted on Finish speakers show the same results in that simple words are easier to process and recall in the brain than inflected and derived words. Derived words are better recalled than inflected words. However, Service and Maury (2015) in their study claim that inflected words are more difficult to process. This is due to the fact that Finnish inflectional suffixes appear to "compete" with WM. On the other hand, their study shows that derivational suffixes are easier to recall because they are "supported by the roots they are attached to" (Service & Maury, 2015, para. 51).

The findings of these studies are further reinforced by the findings of Cohen-Mimran, et al's., study on Arabic speakers in 2013. The study concludes that it is generally more difficult to recall inflected forms than base words forms. They argue that this might be due to the fact that inflected words are more complex because they contain an extra morpheme. Additionally, Taft and Forster (1975) show that words are stored in their basic form. In other words, when one sees a word with a prefix or suffix, these forms will affect the subject's ability to recall the word. Moreover, the subject's memory removes the prefix and suffix from the word in order to look for the base. One of the things this study finds is that it takes a subject longer to remember words with "pseudoprefixes" such as the word 'relish', than words without pseudoprefixes such as the words 'rethink or remind.' For instance, upon viewing the word 'relish', the subjects detach the 're' and looks for the 'lish'. When they do not find 'lish' in their memory, they recombine're' with the 'lish' and then become successful in finding the word 'relish'. Daneman and Case (1981) further bolster Taft and Forster's study in that prefixes and suffixes are stored in the brain separately. Upon observing a word with prefixes and suffixes, subjects have to identify and recall the base and the affixes. Then, they arrange them in a suitable way and produce the correct item. Daneman and Case (1981) claim that it takes longer for WM to process words with affixes. In their study, which train some children to learn an artificial language, they find that it is easier for participants to process suffixed words than prefixed ones. Moreover, prefixed words are easier to process than words with both prefixes and suffixes. This shows that prefixes and suffixes place more burdens on WM. The result of this study is similar to the study of McKinnon et al., (2003) in that they both focus on how morphologically complex words are processed and decomposed in the brain. McKinnon et al's study is different in that it only focuses on the prefixes. Their results are in line with the other study by Daneman and Case (1981). This study maintains that "words and non-words composed of a prefix and a bound stem elicit similar brain responses" (p. 886). These studies show that the brain goes through the process of the morphological decomposition even if the affixed items are not stuck to real words.

Additionally, such researchers as Rubin et al., claim the frequency of a word also has an impact on participants' ability to recall morphologically complex words. This study, unlike the other studies mentioned above, takes into account the role of frequency on affixed words. The study maintains that the frequency of how often certain words appear in the lexicon or how often they are presented to a person can have a significant impact on one's ability at recollection. For example, the word 'impossible' is considered to be familiar to most people because of how often it is utilized in its

lexical form. As a result of this high frequency of use and familiarity, it is quickly recalled and it is represented as one word in the memory. However, the word 'imperceptible', unfamiliar and infrequent in the lexicon, is represented in the memory as two different entities --- a base plus an affix (as cited in Carroll, 2008, p. 123). In other words, the study claims that if an affixed word is a high frequent word, it is processed as one entity in the brain. Only low frequent affixed words are decomposed in the brain.

Another factor that influences a subject's ability to recall is referred to as word frequency. Word frequency refers to the extent a word is used. High frequent words are easier to recall and recognize than low frequent words. This is due to the fact that high frequent words are more common than low frequent ones (Foster & Chambers, 1973; Lee, Oh, Pyun, & Lim, 2009; Whaley, 1978). In their studies, Whaley (1978) and Foster and Chambers (1973) show the effect of word frequency in the lexical decision task and naming task, respectively. They discover that high frequent words are better recognized than low frequent words. These findings are further evidenced in the study done by Lee et al., (2009). They maintain that WM goes through a complex process while trying to recognize and recall a low frequent word. However, the aforesaid results are different from that of the results found in the studies conducted by Malmberg, Steyvers, Stephens, and Shiffrin (2002), Shiffrin and Steyvers (1997) and Zechmeister, (1972). The findings in these studies show that low frequent words are better processed than high frequent words. They maintain that this is due to the fact that low frequent words comprise more "uncommon features" than high frequent words. As a result, this makes the words easier to process.

In addition to the role of the frequency, other factors such as receny and primacy may have an effect on one's ability to recall and recognize words. Clause (2010) explains that the receny effect and the primacy effect are two of the main parts of a larger concept used to explain the concept called the serial position effect. He explains that when participants are given a list of words to recall, they are more likely to remember words at the beginning of the list. These words are called (primacy). Words occurring at the end of the list are referred to as (recency). Concerning primacy, it is believed that items at the beginning of a to-be-remembered list are easier to recognize and recall than items in the middle of a list. This is due to the fact that participants rehearse these items over and over again and as new items are shown to them, they keep rehearsing the previous items along with the new ones. This rehearsal makes them retrieve the first items easier than those in the middle (Rundus, 1971). Glenberg et al., (1980), and Marshall and Werder (1972) expanded Rundus's study. Their research shows that the more time a person has to look at the words, the more likely they will be to recall and recognize the items. This is because they have more time to rehearse these previous words.

Regarding recency, it is claimed that items at the end of a list are easier to recall than items in the middle. Several studies have theorized that the brain often mistakes items in a list for other items from a nearby position in the memory set. For example, the 6th item in a list of words is either mistaken for the 5th item or the 7th item and so forth. Since there are normally more words appearing in the "middle" of the list than the words in the primacy and recency positions, there is more likelihood of errors in recalling these items. These studies show that words appearing in the primacy and recency positions are less likely to be forgotten than words occurring in the middle of the list (Clause, 2010; Madigna, 1971; Penney, 1975). Another study by Neath and Knoedler (1994) claims that the subjects' WM is affected by the positioning of the words in the list. In other words, items at the end of a to-be-remembered list appear to be more different than other items somewhere in the list. As a result, words occurring at the end of the list are more easily recalled. This is quite different from the findings of Howard and Kahana (1999, 2002). In their studies, they take into account the role of "contextual variability model". They believe that on a free-recall test, the recent items are easier to be remembered due to the fact that they possess more similar encoding contexts to the test context. Other researchers including Dallett (1965), Green (1987), Bloom and Watkins (1999), Parmentier, Tremblay, and Jones, (2004), etc. claim that the role of recency is greatly decreased if a 'suffixed item' is added to the to-be-remembered list. This item is added to the end of the to-be-remembered list and it is not required to be recalled. Green (1987) claims that this suffix is more influential in the lists presented auditorily than in lists presented visually. Parmentier et al., (2004) expands this study. In their study, they claim that the suffix is really influential if it is phonologically similar to the last item. However, a suffix that is not phonologically similar (e.g., B, T) to the last item does not diminish the recency effect.

All the factors discussed in the literature review such as word length affect, phonological similarity, word frequency, as well as primacy and recency have a dramatic effect on a subjects' WM at recollection. As this literature review shows, there have been many studies looking into the different affects these factors have on an individual's ability to recall information from their WM.

3. Methodology

This study aimed to investigate word recall in Arabic and English. It looked into whether prefixed or suffixed verbs were recalled differently in both languages. It also aimed to investigate whether suffixed verbs are easier to recall or prefixed ones. Fourteen verbs with prefixes and 14 with suffixes in each language were shown to the participants.

3.1 Variables

This study had one independent variable, and one dependent variable. The independent variable was the suffixed and prefixed verbs in both Arabic and English, whereas the dependent variable was the working memory performance.

3.2 Participants

The study was conducted on 10 graduate students whose first language is Arabic and second language is English. They study different majors at a university in the Midwest of the US. All of the participants were men because gender was not a variable in the study. They were all between the age of 25 and 35.

3.3 Materials

Since this study was concerned with Arabic and English verbs, 14 prefixed verbs and 14 suffixed verbs from each language were selected for this experiment. In each language, the total number of verbs that were shown to the participants was 28; a total of 56 in both languages. The first group in each language consisted of 14 verbs with suffixes that reflected the diverse ways in which suffixes may be attached to Arabic and English verbs. The second group in each language consisted of 14 verbs with prefixes that likewise represented the different ways in which suffixes may be attached to Arabic and English verbs.

3.4 Procedure

The researchers contacted 10 Arabic graduate students at a university in the Midwest of the US and arranged to meet them at a time when all of them would be available. The two experiments were done in two different times with a period of two weeks between the first and the second experiment. The first experiment was on Arabic and the second was on English. In both experiments, the same group of graduate students participated.

To increase the reliability of the study, the experiments were conducted under controlled conditions in terms of time and place. The meeting took place in the library between 6 and 8 pm. Noise and other extraneous factors were also controlled. The researchers started by explaining the procedures of the study and what was expected from the participants. These procedures included that the participants would see a list of 14 verbs. Each verb was shown in a separate power point slide which was timed to appear for two seconds for every verb. After showing each set of words, the participants were given a time of five minutes and a well-organized answer sheet to write the verbs they could recall. They were also asked to mention both the reasons that made them remember those verbs and techniques they employed to recall the verbs. The researchers also explained to the participants that because this study was concerned with free recall of words, they would not have to pay attention to the order of the verbs. All the procedures mentioned above were applied to the next experiment on English prefixed and suffixed verbs.

4. Results and Discussion

The data analysis included the calculation of descriptive statistics and four dependent t-tests. The first step was to analyze the prefixed and suffixed Arabic verbs. The second phase was to analyze the prefixed and suffixed English verbs. The third step was to analyze the prefixed verbs in both Arabic and English. The final step was to analyze the suffixed verbs in both Arabic and English.

4.1. Prefixed and Suffixed Arabic Verbs

The first experiment aimed to investigate the recalling of Arabic prefixed and suffixed verbs in relation to the working memory. A group of 10 graduate students were randomly selected to participate in the experiment. The participants were first tested on their ability to recall Arabic prefixed verbs and then their recall of Arabic suffixed verbs. As the experiment was conducted on the same group, a *t-test* for dependent samples was deemed appropriate for the statistical analysis. The descriptive and t-test results are summarized in Table 1 below.

Table 1. Comparison of recalling prefixed and suffixed Arabic verbs

Arabic Verbs	N	Mean	SD	Mean difference	t(9)	Sig. two-tailed	Effect size d	r	Sig
Prefixed Arabic verbs	10	5.9	1.44						
Suffixed Arabic Verbs	10	6.4	1.83	.964	-1.17	.273	0.30	.684	.029

It can be clearly observed from Table 1 that the Arabic verbs with suffixes (Mean = 6.4) were recalled more than the verbs with prefixes (Mean = 5.9). However, the difference was not statistically significant, $t(9) = -1.17$, $p = .237$, Cohen's $d = 0.30$. In addition, the small value of the effect size (Cohen's $d = 0.30$) showed that the difference in recalling Arabic prefixed and suffixed verbs was not significant. This interpretation is in view of Cohen's (1988) effect size scale, where $d = .20$ indicates small effect size; $d = .50$ indicates medium effect size, and $d =$ or $> .80$ indicates large effect size. Additional insight was brought by examining the correlation coefficient which showed a moderately high positive value $r = .684$ which was also statistically significant, $p = .029$.

Overall, the participants were able to recall 64 words with suffixes and 59 words with prefixes. An interesting result was observed when some of the participants added suffixes that were not part of the target words. For example, the word "جمعت" *Jamaat* was shown to the participants but one of the participants wrote it as "جمعنا" *Jamaana*. In Arabic, the former indicates a singular form "I collected" whereas the latter indicates the plural form "we collected". Eight words with suffixes out of 64 were written with different suffixes. On the other hand, 25 words with prefixes out of 59 were written with different prefixes from the original words. This clearly illustrates that prefixes were very difficult to recall compared to suffixes.

Some of the participants reported that the verbs with suffixes were easily recalled which might be due to the fact that the base of the word attracted their attention first and they were not distracted by the availability of the prefix. According to Taft and Forster (1975), the words are stored in their basic form, which means that the participant would

be first looking for the base, and if the words included prefixes, it would be hard for the participants to get the base of the word promptly. Further, the findings of the current study are also in line with that of the study by Daneman and Case (1981), which maintains that suffixed words are easier to process and recall than prefixed ones. Further, in the current study, it was observed that when the participants saw the words, the base of these words helped them remember. So, when there were words with suffixes, the participants found them easy to recall because the word base was placed at the beginning, which is different from words with prefixes that the participants had to first read the prefix and then the word base. For example, the word "نجحنا " *najahna* which means "we succeeded" will be put in its base form "نجح" *najaha* and thus will be easier to remember. However, when the participants viewed the word "نفضل" *nafdhal*, which consists of the prefix *na* 'ن' and the base *fadhala* 'فضل', they first attempted to process whether the prefix is a part of the word. In this case, they first removed the prefix *na*'ن' from *fadhala*'فضل', and then made a search for the base. Therefore, this process took the participants longer time to process the word and recall it to their mind. Sometimes, it caused the participants to forget the whole word. This was further illustrated by the same example when it was shown to the participants as "نجحنا" *najahna*, but what some of the participants wrote was "نجحوا" *najahoo*. It can be seen that the base of the word which is "نجح" najaha was recalled successfully, but the problem was with the suffix where it was substituted with a different one. This shows the importance of the base in word recall.

Another factor that played a vital role in remembering the words is the easiness of the words. This phenomenon is described by Baddeley, Thomson, and Buchanan (1975) as word-length effect. Most of the participants recalled the words that were easily written and that had few numbers of letters. Words like "طارت" *tarat* and "نجحنا" *najahna* were the most recalled words with suffixes. This is mainly due to the easiness of these words. This finding further bolsters Campoy's study in 2008, which shows that those words that comprise four phonemes are recalled easier than those words that consist of six phonemes.

Additionally, the words that were common in everyday life were easily recalled. That is, the high frequent words have also great impact on the participants' capacity in word recollection. For example, the word "نجحنا" *najahna* which means "we succeeded" is both easy and commonly used. Therefore, almost all participants were able to recall this word. This finding is similar to the studies conducted by Foster & Chambers (1973), Lee et al., (2009), and Whaley (1978). All of these study show that high frequent words are better recognized and recalled than low frequent one. This is because WM, as Lee et al., (2009) maintain, goes through a complex process while trying to recognize and recall a low frequent word. Interestingly, there was an unexpected result from two participants. These participants recalled few difficult words, such as "يستعصي" *yastaasi* and could not recall the easy ones. The reasons they gave for this is that they paid too much attention to the difficult words and that made them forget all the easy ones. Further, According to the participants, these verbs were not familiar to them and consequently, they caught their attention. This might be because low frequent words comprise more "uncommon features" than high frequent words. As a result, this makes the words easier to process (Malmberg et al., 2002; Shiffrin & Steyvers, 1997; Zechmeister, 1972).

Clause (2010) maintains that serial position effect is a larger term consisting of two other terms: recency effect and primacy effect. When subjects are shown a list of words to remember, it is easier for them to remember words at the beginning of the list (primacy) and at the end of the list (recency). However, words in the middle are difficult to remember. For example, these two words, "نهضت" *nahadna, "*نبتسم" *nabtasim,* were shown at the beginning. Most of the participants were able to remember these words because they were at the beginning. Some of the participants mentioned that the words at the beginning were remembered more than the words at the end. That was because when the subjects heard the verbs at the beginning of the showing the slides, they kept repeating them over and over again in their WM items along with the newly presented ones and transferred them to their long-term memory. The findings of the current study about recency and primacy provide further support to the studies done by Bjork and Whitten (1974), Brodie and Murdock, (1977); Clause, (2010); Glenberg et al., 1980; Neath and Knoedler (1994), and Rundus, (1971)

Concerning the techniques used by the participants, some participants mentioned that they remembered some words because they experienced them just right before the session. They used this as a technique to better remember the verbs. For example, they recalled the word "يأكل" *yakol* which means 'he eats' because they had dinner right before the experiment. Some of the participants connected the words with things available around them during the experiment. For example, one the participants recalled the word "نطبع" *natba* which means 'we print'; he reported that he recalled this word because there was a printer in the room where the experiment was conducted. In addition, most of the participants reported that they used word grouping to better recall the verbs. For instance, they grouped together some verbs to create phrases and sentences of their own type, such as "بعنا و رجعنا" *bina w rajana,* " لعبنا و نجحنا *laabna w njahna,* يرمى و "يضرب" *yiarmi w yadhrub.* The meanings of these chunks are "we sold and we returned, we played and we succeeded, and he throws and he hits, respectively".

Additionally, some of the words had similar syllable structures. For example, the words "بعنا,نجحنا ، لعبنا " had similar suffixes. As these words had similar endings, some of the participants found them easier to recall than those words that were completely different. The similarities between some of the verbs utilized as a technique by some of the participants to better recall the verbs. Further, this finding further supports the findings in the study done by Copeland and Radvansky (2001). The results in this study demonstrate that similarities between the to-be-remembered items do not prevent WM from being recalled. On the contrary, those words that were similar in sounds and features are recalled more than those that were not. However, the findings in the current study is the opposite of the studies done by Baddeley (1966) and Conrad and Hull (1964), which show that words that are similar in rhythm are more difficult to recall than words that are not rhythmic. Also, the findings of this study is not in line with the study done by Baddeley

which maintains that similarities in features between two words and/or sounds make it more difficult for the WM to recall the item. In other words, the more features and similarities there are between the to-be-remembered items; the greater the chance there will be of forgetting the items (as cited in Cathercole & Baddeley, 1993, p. 12).

4.2. Prefixed and Suffixed English Verbs

The second step of the analysis was to examine the recalling of English prefixed and suffixed verbs in relation to WM. The same group of graduate students participated in this experiment and the same analytical procedures were applied. A dependent *t-test* was also performed. The descriptive statistics and the *t-test* results are summarized in Table 2 below.

Table 2. Comparison of recalling prefixed and suffixed English verbs.

English Verbs	N	Mean	SD	Mean difference	t(9)	Sig. two-tailed	Effect size d	r	Sig
Prefixed English verbs	10	9.2	1.87						
Suffixed English Verbs	10	9.0	2.40	.964	.208	.840	0.092	.000	1.000

It can be observed from Table 2 that English prefixed verbs were slightly easier to recall than English suffixed verbs. Specifically, the group of prefixed English verbs had a slightly higher Mean score (9.2), than the group of suffixed English verbs (9.0). The dependent t-test revealed that there was no significant difference in the recalling of English prefixed and suffixed verbs, $t(9) = .208$, $p = .840$, Cohen's $d = 0.092$. This was further supported by the small value of the effect size (Cohen's d = 0.092). It can also be observed that there was no linear relationship between the recall of words with prefixes and suffixes, $r = .000$, significant = 1.

Although English was the second language for all the participants, the total number of recalled English verbs was more than the recalled Arabic verbs. Specifically, they recalled 182 English verbs compared to only 123 Arabic verbs.

The total number of prefixed verbs with different bases and correct prefixes is eleven. The participants successfully recalled the majority of the prefixes, but they attached different bases to many of them. For instance, one of the participants recalled the verb 'distrust' as 'distract'. The same is true for another participant who remembered the verb 'enrich' as 'enreach'. However, the total number of such mistakes in Arabic is only one, which is substantially lower from those made in English. This is evidenced by the word "نوحل", which was "نرحل" 'we leave' in the list of the verbs given to the participants to recall.

Concerning the complete mismatch, the total number of prefixed verbs in English is four. These four numbers are completely different from the list of prefixed verbs given to the participants to recall. For example, one of the participants recalled the verb 'distrust and deactivate' as 'dustart and didactive', respectively. They are not found in the list of the words. However, in Arabic, the total number is one, which is "تحصى".

Regarding the suffixes, in English the total number is four for the correct suffix with different bases. Concerning the complete mismatch, the total number of the remembered suffixed verbs is two. For example, 'liqiutatz' and 'Modernalize' are two complete mismatches found in the data. On the contrary, in the Arabic language, the total verbs answered correctly according to suffixes with different bases are six. For instance, the Arabic verb 'اكلوا' "we ate" consisted of the suffix 'وا' which is available in the data, whereas the verb "اكل' is not.

Based on the data from the experiment it can be shown that most of the participants misspelled verbs. For instance, the verbs "beautify, misinterpret, computerize, and desensitize'' were spelled as 'buitify, Misinterpet, computirize, desensasse', respectively. However, the majority of the affixes have not undergone any misspellings. The misspellings occurred only in the bases. This might be due to the fact that English has an opaque orthography and often includes a less direct correspondence between letters and sounds (Field, 2003). The participants are also non-native speakers of English, which is another factor that could lead the participants to make mistakes in spelling the verbs.

Another important finding in the data indicates that the participants sometimes added suffixes to the verbs. This often resulted in creating unacceptable verb forms in English. This is shown in the verbs 'misunderstanded', oversleept, liquident. The participants did the same thing to the prefixed verbs. That is, they attached prefixes of their own type to the verbs, which resulted in unacceptable verbs in English. 'du and did', which are unacceptable prefixes in English, were attached to the verbs 'start' and 'active', respectively.

Besides, it can also be observed that frequency played significant role in enabling the participants to recall the prefixed and suffixed verbs. This finding provides further support for the studies done by Foster & Chambers (1973), Lee et al., (2009), and Whaley (1978). These studies claim that high frequent words are better recalled than low frequent one. This phenomenon is also discussed in detail by Taylor (2013) and Lee et al., (2009), who both claim that high frequent words are easy to remember as people are highly exposed to them in everyday life. This is not true for the low frequent words. This is because they, as Taylor says, are not familiar to people and are not employed a lot in everyday life. Taylor (2013) further explains that high frequent words needs less effort as they can easily come to mind, whereas low frequent words requires a lot of effort because the "memory needs to be searched extensively to locate the word and its meaning" (p. 1175). The high frequent words in the list of the prefixed verbs were recalled most by the participants. Most of the

participants mentioned that they were very exposed to these verbs in their everyday lives. This shows that the high frequent words are less prone to error than the low frequent words. For example, such verbs as 'reread, misunderstand, and rewrite' were amidst the most recalled prefixed verbs in the list. The same thing can be applied to the suffixed verbs in English. The participants were also able to easily remember those suffixed verbs that are high frequent. For instance, the suffixed verbs 'eaten, teaches, worked, planning, and computerize' are the most remembered verbs in the given list. Almost all the participants could easily recall these verbs. One of the participants talked about his recollection of the verbs and wrote that he was able to remember the verb 'worked' easily due to the word 'homework' to which he is highly exposed. Additionally, another participant mentioned that the suffixed verb 'teach' was the easiest word for him as he utilizes it every day in school. However, the verbs 'depicting, moisten, liquidate, desensitize, regain, and foresee' recalled least in the list of suffixed and prefixed verbs, respectively. The same holds true for the Arabic verbs discussed above. This phenomenon is also discussed in detail by Taylor (2013) and Lee et al., (2009), who both claim that high frequent words are easy to remember as people are highly exposed to them in everyday life.

In addition to the role of the frequency, receny and primacy are other factors that lead the participants to recall the prefixed and suffixed verbs. The participants are more likely to recall verbs presented at the beginning and end of the list of the to-be-remember verbs. On the contrary, the verbs in the middle of the list require more effort to recall. This phenomenon was also mentioned by some of the participants, saying that they were able to remember some of the verbs because they were at the beginning of the list of the to-be-remembered prefixed and suffixed verbs. This is due to the fact that words coming at the beginning of the words have primacy effect (Brodie & Murdock, 1977; Clause, 2010; Glenberg et al., 1980; Rundus, 1971). This shows that the findings in this study are in favor of the studies done by Brodie and Murdock (1977) and Rundus (1971). For instance, the verbs 'teaches, planning, deactivate, and reread' were remembered most by the participants, because they, as mentioned by some of the participants, were at the beginning of the list. They paid much attention to these verbs. The same holds true for the words that come at the end of the list (recency effect). Some of the participants also mentioned that they remembered the verbs because they were at the end of the list. This finding is further supported by the studies conducted by Bjork and Whitten (1974), and ,Neath and Knoedler (1994). For example, most of the participants recalled the verbs "misunderstand and computerize", that were at the end of the list. In terms of whether primacy or recency is more powerful, the primacy is more powerful. This is because when the participants, as mentioned by them, heard the verbs at the beginning of the to-be-remembered words, they kept repeating the verbs over and over again in their short term memory to transfer them to their long term memory. Besides, the findings of this study concerning recency and primacy in English are similar to that of the findings in Arabic language.

Interestingly, regarding the techniques that were used to recall the verbs, the participants attempted to create sentences from the verbs in the list of the to-be- remembered verbs. For instance, some of the participants mentioned that they created some phrases of their own type from the list of the verbs to better recall the words, such as 'soften speaking', 'planning to teaches' , misunderstand to rewrite'. The same holds true for the Arabic verbs where students created chunks of their own types from the list. Although the phrases they created are ungrammatical, they used them as cues to help them better remember the verbs. Another technique that helped the participants recall the verbs was overgeneralizing the prefixes and/or suffixes to many verbs. For example, the prefix 're' in verbs like 'reread' was generalized to other verbs that were not even on the list as 'refrozen'. More interestingly, the participants made a connection between all the similar prefixes or suffixes. For example, the prefix 'mis' was grouped with verbs like 'misunderstand', 'misinterpret'. Another example of suffixes was the 'ing', which was connected with verbs like 'speaking', 'working', 'planning', 'depicting'. These techniques, according to the participants, helped them to recall many of the prefixed and suffixed verbs. This holds true for the Arabic verbs where the participants reported that verbs that had similar structures were easier to recall.

4.3. Prefixed English and Arabic verbs

The third phase of analyzing the data was to compare the recalling of prefixed verbs in both Arabic and English. The statistical analysis (see Table 3) showed that performance on the prefixed English verbs was significantly better than on the Arabic prefixed verbs, $t(9) = -6.37$, $p < .001$, Cohen's $d = 1.79$. Specifically, the English prefixed group had a significantly higher Mean score (Mean = 9.2) than the Arabic prefixed group (Mean = 5.9). Following Cohen's (1988) reference, the effect size $d = 1.97$ shows a large effect size. In other words, this effect size can be interpreted to mean that recalling the prefixed verbs in both Arabic and English was not only statistically significant, but is also of great practical importance that deserve the attention of researchers to find the impact of first and second language on the working memory. In addition, the correlation coefficient showed a moderate positive value $r = .540$, but it was not statistically significant, $p = .107$. Table 3 below summarizes the results of the descriptive statistics and the dependent t-test.

Table 3. Comparison of recalling prefixed verbs in English and Arabic.

Prefixed Arabic and English Verbs	N	Mean	SD	Mean Difference	t(9)	Sig. two-tailed	Effect size d	R	Sig
Prefixed Arabic verbs	10	5.9	1.44						
Prefixed English Verbs	10	9.2	1.87	.517	-6.37	.000	1.97	.540	.107

4.4 Suffixed English and Arabic verbs

The fourth phase of analyzing the data was to compare the recalling process of suffixed verbs in both Arabic and English. The same procedures were applied here where descriptive statistics were calculated and a dependent *t-test* was performed. A summary of the descriptive statistics and the dependent t-test is clearly illustrated in Table 4 below.

Table 4. Comparison of recalling prefixed and suffixed English verbs.

Suffixed Arabic and English Verbs	N	Mean	SD	Mean difference	t(9)	Sig. two-tailed	Effect size d	R	Sig
Suffixed Arabic verbs	10	6.4	1.8						
Suffixed English Verbs	10	9.0	2.4	.806	-3.22	.01	1.97	.302	.397

It can be clearly observed from Table 4 that the English suffixed verbs (Mean = 9.0) were recalled more than the Arabic suffixed verbs (Mean = 6.4 and the difference was statistically significant, $t(9) = -3.22$, $p = .01$, Cohen's $d = 1.97$. Following Cohen's (1988) reference, the effect size $d = 1.97$ shows a large effect size. In other words, this effect size signals the importance of studying the recalling of words among bilingual speakers in relation to the working memory. In addition, the correlation coefficient showed a low value $r = .302$, and it was not statistically significant, $p =. 397$.

4.5 Summary of Findings

It can be concluded that in English the participants recalled prefixed English verbs more often than suffixed verbs, whereas in Arabic the situation is the opposite. However, by calculating the descriptive statistics and the dependent t-test results, it turned out that there was only two significant differences among the four compared groups, which were both in the comparison between prefixed and suffixed verbs in both English and Arabic. Specifically, the English prefixed group had a significantly higher Mean score (Mean = 9.2) than the Arabic prefixed group (Mean = 5.9) and the English suffixed group had a higher mean (Mean = 9.0) than the Arabic suffixed group (Mean = 6.4). In conclusion, there was a difference between the verbs recalled in Arabic to the verbs recalled in English, which raises more questions about the role of the first and the second language in relation to the working memory.

5. Conclusion

This study aimed to investigate whether or not the prefixed and suffixed verbs are recalled differently in both Arabic and English. The study also examined the different techniques used to recall the verbs in both languages, and if it required extra effort on the working memory to recall words in a second language. The study hypothesized that recalling words with suffixes would be easier than words with prefixes. It was also assumed that the participants would have similar results in both Arabic and English with the former as their first language and the latter as their second language. The researchers built this hypothesis based on several studies that have been discussed above.

The study included two experiments on a group of10 Arabic-English bilingual speakers. The first experiment was on Arabic prefixed and suffixed verbs whereas the second experiment was conducted similarly on English. In Arabic, the study supported the hypothesis that suffixed verbs are easier to recall than prefixed verbs. Particularly, the participants successfully recalled 64 verbs with suffixes compared to 59 verbs with prefixes. However, in English, the study revealed different results where prefixed verbs were recalled slightly more than suffixed verbs. Specifically, 92 prefixed verbs and 90 suffixed verbs were recalled. Comparing all the verbs recalled in both Arabic and English, the study revealed that the total number of English verbs exceeded the number of Arabic verbs. The participants recalled 182 English verbs compared to only 127 Arabic verbs. This shows that L2 does not differ from L1 in the effort exerted to recall words. Rather, the result may suggest that it is easier to recall words in the second language, which might be due to the intensive instruction received in the second language.

Based on the data, the study revealed that the base of the word is the first thing the participants looked for. Therefore, it was easy for the participants to recall verbs attached to suffixes, rather than the verbs that were attached to prefixes. This is because the suffix comes at the end of verbs and that made no distraction for the participant to immediately recognize the base. Although, the participants recalled more prefixed verbs in English, still the difference was not statistically significant.

Additionally, the study found that several other factors helped the participants recall the verbs in both languages. For instance, word-length effect is one of the factors that had a significant impact on the participants' WM capacity where recalling was faster with verbs that were short or contained one syllable. In addition, factors such as frequency, recency and primacy made it easy for the participates to recall more verbs in both languages. For example, the common, frequent verbs were recalled more than the infrequent ones. The verbs that were employed by the participants right before the experiment were recalled easier than those that were not.

The study was limited by the small number of participants and the limited number of verbs. The sample size of the participants and words could have been expanded. Ideally, the number of participants would have included equal number of males and females. A larger sample with participants from different educational backgrounds would have benefited the findings of this study. Since this study was done on only bilinguals of Arabic and English, the results

might not be generalized to other languages or bilinguals of other languages as every language has a different morphological structure. Further research on a large sample on other bilinguals is recommended.

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