On Lexical Storage:Evidence from Non-native Speakers of English

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This paper will deal in outline form with the issue of word representation in the mental lexicon.Also, an experiment conducted on non-native speakers of English will be reported together with some pedagogical implications.

Introductory background

The connection between models of language processing and those of memory is an intimate one.Views about the nature of meaning, including those about the form in which linguistic units are stored in memory, have large implications for models of language comprehension (for a review, see Garman,1990) .The language user must make use of the linguistic building blocks that are stored in the memory system to aid in constructing the internal representation of the sentence.These representations are in turn used to make inferences about the meaning .Because of this close relationship the topics of comprehension and meaning cannot be sharply separated.

Since there are many theories about comprehension and sentence representation, it is natural that there are also many assumptions about how lexical information is represented in the memory system of the language user.Thus, it is reasonable to discuss the mental representation of words or morphemes before one discusses higher-level comprehension processes.

It is likely that the morphological structure of an utterance may have some impact on its comprehension.This view may solve in part the problem of segmentation in speech perception.A listener, who

knows that '-ly' is a morpheme usually coming word finally, may succeed in segmenting an utterance such as 'swiftlymovingobjects' into 'swiftly' and 'movingobjects'.Similarly, the knowledge that '-ing' is a morpheme would help the listener to segment 'moving' from 'objects'.Thus, success in segmenting a speech signal into morphemes would pave the way for the stage of lexical look-up(the process by which the individual words are retrieved from the mental dictionary).Also, morphemes may be used as clues to recovering the syntactic structure of the utterance.Naturally, the syntactic structure of any utterance is crucial for its comprehension.Thus, a multimorphemic word may be stored in the mental lexicon as a stem and other affixes.The essential syntactic and semantic information may be listed with the stem and a rule specifying how that information is used when other affixes occur.For example, a word like 'eating' may be stored in the mental dictionary as 'eat' and '-ing'.The productive morpheme '-ing' is helpful in recovering the syntactic structure of the utterance which is necessary to its understanding.Some evidence may be presented to support this view which may be called the 'derivational view'. (Mackay,1976,cited in Clark and Clark,1977,p.285).

The 'tip-of-the-tongue' phenomenon stimulated by Brown and McNeill (1966,cited in ibid.,p.170) may provide evidence about the nature of the basic units stored in the mental dictionary.It seems that words are not represented in the memory system as indivisible entities; rather, they are stored as discrete parts since in this phenomenon both phonological and semantic aspects of the words were partially retrieved.Brown and McNeill read brief definitions to their subjects and required them to supply the word defined.Although the subjects knew the word they could not quite remember it .When asked,subjects were somewhat able to mention the number of syllables the word had and its initial letter.Subjects also gave words which were similar in meaning or in sound to the target word.For example, if

the target word was 'sextant' subjects gave similar words in meaning such as 'compass, astrolabe, or protractor' or they gave words similar in sound such as 'secant, sextet or sexton'.

Slips of the tongue provide evidence for the nature of lexical storage in the mental lexicon.They reveal that word stems get separated from affixes (inflectional or derivational).Additionally, the production of non-words , in speech errors, show that morphologically complex words are formed by the application of morphological rules.Consider the following speech errors: (1) is quoted from (Akmajian et.al.,1995, p. 398) , and the others are quoted from (Garman ,op.cit.,p.158)

1- Work is the curse of the drinking class. (Drink is the curse of the working class).
2- He facilitated what he was doing to remove the barricade. (He removed the barricade to facilitate what he was doing.)
3- You have to square it facely. (You have to face it squarely).
4- I thought the park was trucked. (I thought the truck was parked).
5- I've got a lot of cooken chicked (…a lot of cooked chicken).
6- The derival of the surface form (the derivation of the surface form)

In (1) the '-ing' remained in its intended position while 'work' and 'drink

changed positions.In (2) the (-ed) remained in its right position but 'facilitate' and 'remove' traded positions.In (3) the (-ly) stayed but 'square' and 'face' changed their locations.In (4) the (-ed) kept its correct place while 'park' and 'truck' swapped positions.In (5) the (-ed) remained in its intended place,and a nonword is produced by applying morphological rules.(5) shows that a nonword 'derival' is formed by the application of rules.The above data from speech errors square well with the derivational view of lexical storage that multimorphemic words are not represented as single entries in the mental dictionary but

are formed from single morphemes by the application of morphological rules of word formation.

Evidence from child language acquisition supports the derivational view of lexical storage.It seems that children acquire rules for the production of past tense forms or plural forms.A child who says

I taked a cookie, is overgeneralizing the rule for the regular past tense by using the regular past tense suffix '-ed' with an irregular verb (i.e.,take).This can be explained that the child has mastered a rule (present + ed) for deriving the regular past tense.

Furthermore, Berko (1958, cited in Akmajian et.al.,op.cit.,p.468 required children to provide the plural forms for some nonsense words such as (wug).Children were able to add the plural suffix (e.g.,) wugs).This ability to add the right suffixes to completely new nonsense words indicates that children seem to have mastered a concept that the plural form of a word is the singular form with something appended.

In sum,we have presented quite selectively some suggestions and current views regarding the issue of lexical storage. It must be emphasized that this matter is controversial and there is no settled view concerning this area of research in psycholinguistics;hence much research remains to be done.(See Gleason and Ratner, 1998).

The Experiment

Introduction

This experiment is about the recall of past tense verbs (regular and irregular) in English by non-native speakers.It is an attempt to answer the question whether the past tense form of a verb is stored in the permanent memory as a single entry (with the semantic information and the past tense suffix attached to it) or as two units , (present + ed), to be mingled into one unit by some later process.

It has been shown in the previous section that these two answers represent two different assumptions about lexical storage and retrieval from memory.In actual fact,these two answers represent two opposing assumptions concerning word storage and retrieval.The first view, which may be called the whole-word hypothesis, states that words (simple or complex) are represented as single entries in the mental dictionary.these
Entries are retrieved as fully integrated phonological units in natural speech.On this theory, therefore, the past tense form 'dug' is stored and retrieved as a single unit without reference to its stem morpheme 'dig'.

The second hypothesis which we called the derivational view maintains that stems and affixes are represented as separate items in the brain and that words such as 'agreement' and 'talked' are generated by applying suffix rules to the respective base forms 'agree' and 'talk'.It is hypothesized by this theory that verbs such as 'dug' are produced by application of the rule of vowel alteration / i > ^ / to the base /dig/ which resembles the infinitive.

The evident implication of the derivational hypothesis is that semantic representation for recalling [d^ g] must be componential, resembling [dig] + [past].The whole-word hypothesis implies that for past tense forms such as 'dug' to be stored as separate independent items at the phonological level, a unitary semantic representation is possible as well.

Subjects

The subjects participated in this experiment were ten undergraduate students most of whom were fourth year students of English in Jerash Private University.

Material

The experimental materials consisted of 49 verbs as shown in the following table:

Complexity level 0 ; no ending

beat, set, rid, cut, bid, put.

Complexity level 1 : regular ending

1- /t/ ending

kiss , walk , leak , push , kick , tap .

kissed, walked,leaked,pushed,kicked,tapped.

2- /d/ ending

pit , gain , rob , fail , chill , rig , rub .

pitted,gained,robbed,failed,chilled,rigged,rubbed.

3- /id/ ending

pit , dot , pat , rate , need , wade .

pitted,dotted,patted,rated, needed,waded.

Complexity level 2:

1- vowel change

tear , dig , run , sit , fall , wear , swim .

tore , dug , ran , sat , fell , wore , swam .

2- Consonant change

lend , build , have , send , make , bend .

lent , built , had , sent , made , bent .

3- Glide change

find

found

Complexity level 3;

Vowel and glide change

hide , ride , choose , shoot , give .

hid , rode, chose , shot ,gave .

Complexity level 4:

Vowel , glide and consonant change :

teach , weep , sell , lose , seek , feel.

taught, wept , sold, lost , sought,felt.

The main independent variable was complexity level, (as shown above) as a measure of the number of phonological differences

between the stem and the past tense form.Complexity level 0 is given to the irregular verbs (such as beat-beat) that need no phonological changes.Regular verbs (such as walk-walked), which are more phonologically complex than level 0 verbs are called complexity level 1 and so on.

The text frequencies of verbs were looked up in 'The teacher's word book of 30,ooo word' by Thorndike and Lorge.Most of the verbs have high frequency of occurrence. They occur between 50-100 times per million.

Procedure

All subjects listened simultaneously to the following instructions: 'You will hear a list of verbs in the present tense and in the past tense.You are required to transform them into past tense or present tense as quickly as possible.If the verb is in the present tense, change it into past tense. If it is in the past tense, change it into the present tense. After you have given your response, write down on your check sheet what you thought the stimulus verb was so that we can determine whether you heard the verb correctly.'

The verbs were presented in the following random order:

1- bent 2-fail 3-tapped 4-sent 5-rated 6-rubbed 7- leak 8- kick 9- beat
10- have 11- cut 12- bid 13- fell 14- swim 15- seek 16- tear 17- set
18- teach 19- hid 20- walk 21- sell 22- rid 23- felt 24- dotted
25- gain 26- wore 27- build 28- made 29- kiss 30- give 31- needed
32- lost 33- chilled 34- put 35- find 36- run 37- rode 38- pit 39- dig
40- lend 41- wade 42- rig 43- chose 44- shoot 45- pushed 46- sat
47- pat 48- robbed 49- wept.

Apart from the five irregular verbs requiring no phonological change, the verbs were given in both present and past forms. An interval of approximately seven seconds was left after each verb.

Though the instructions were undoubtedly clear, subjects tended to write down the stimulus first and give their response. This allowed them enough time to say and write the same thing, or as put by one subject,' Sometimes it is difficult to remember what was to be written down. It's like trying to pat your head and cycle your stomach at the same time! I automatically wanted to write or say the same thing.'

In the light of this apparent confusion, which rendered the results unreliable, we decided to conduct the experiment again omitting the request to write down the verbs heard and including a plea for speed in the instructions. So, we changed the instructions and also replaced some of the ambiguous verbs with unambiguous ones. The revised instructions were as follows:

' You will hear a list of verbs in the present tense and in the past tense . You are required to transform them into past tense or present tense. Please give your response as quickly as possible. Speed is very important for this test.'

The verbs 'find' and 'wade' were replaced by 'grind' and 'fade'. The rest of the verbs were not changed. The verbs were presented to the subjects in the same previous random order. An interval of approximately five seconds was left after each verb.Different subjects were used. They were also ten undergraduate students most of whom were fourth year students, Department of English, University of Jerash.

Results

The errors committed by subjects were as follows:

On 490 trials (i.e., 10 subjects by 49 items) there were 60 errors (=12.24%). The total number of errors for past tense stimuli 22 and for present tense stimuli the total number of errors was 38. The total number of errors for complexity levels were as follows:

Complexity level 0 : 6
Complexity level 1 : 8
Complexity level 2: 13
Complexity level 3 : 12
Complexity level 4 : 21

60 total number of errors for all items.

The errors committed by subjects can be classified into two categories, namely, misperceptions and response errors.

Misperceptions

Misperceptions were scored when subjects failed to give any response.Only five occurrences of verbs so misperceived took place. These errors are not included in the table above.

Response errors

Response errors were scored when subjects gave erroneous responses. Two major classes of response errors, regularization versus nonregularization showed basically different relations with derivational complexity.

Nonregularization

Nonregularization included mistransformation, and nontranformation of vowels and consonants.

Mistransformations were scored when subjects alternated vowels or consonants either partially or inappropriately. In the case of partial alternation, some but not all of the appropriate derivational steps were carried out.

Stimulus	**Response**	**Correct response**
grind	**/graun/**	**ground /graund/**
seek	**/sok/**	**sought /so:t/**
rig	**/rag/**	**rigged /rigid/**
pit	**/pat/**	**pitted /pitid/**
set	**/sed/**	**set /set/**
bid	**/bet/**	**bid /bid/**
fell	**/fi:l/**	**fall /fo:l/**

In the case of (grind, seek) partial vowel alternation occurred only. In the case of inappropriate alterations subjects misapplied alteration rules appropriate for other lexical items such as (ring-rang, sink-sank) as in /rag//, /bet/, /sed/, and /fi:l/. All these feature alterations seem to be appropriate for some other items in the mental lexicon.

Inappropriate consonant alteration occurred twice (i.e., bid, /bet/ and set, /sed/).

Nontransformation:

Nontransformations were scored whenever subjects repeated stimulus without making any change whatsoever (excluding complexity level 0 where repetition is appropriate) :

Complexity level 1 :

Leak – leak

Complexity level 2 :

pit-pit (twice)
pat-pat (twice)
run-run (twice0
build-build
wore-wore

Complexity level 3 :

hid-hid (four times)
shoot-shoot (three times)

Complexity level 4 :

teach-teach (twice)
sell-sell (four times)
wept-wept (twice)

Nontransformations were more frequent for irregular than regular verbs (23 versus 5) and increased with complexity level:

Complexity level 2 : four irregular nontransformations.
Complexity level 3 : seven irregular nontransformations.
Complexity level 4 : twelve irregular nontransformations.

The errors were significantly more common for present than past tense stimulus (21 versus 7).

Misinflection

Misinflections were scored whenever subjects produced inappropriate inflectional forms:

Stimulus	response	Correct response
hid	hidden	hide
wore	worn	wear

The significant thing, here, is that only verb inflection suffixes were added and not just any suffixes. Derivational suffixes such as –er (teach-teacher) or suffixes appropriate to other syntactic categories (teach-teachly) were never mistakenly added.

Stuttering:

Stimulus	Response		
bent	be, bend		
bent	bent, bend		
wore	worn,eh, wear		
wore	wore, wear		
rode	ro, ride	wept	we, weep
rode	ri, ride	lost	/lu/, lose
hid	hidden, hide	lost	/lou/, lose
hid	hid, hide	lost	/l-l-l/ lose
teach	ti, taught		
teach	teach, taught		

The above data show that subjects either repeated an initial consonant, or a consonant and a vowel. It also shows that subjects

prolonged an initial consonant, an initial consonant and a vowel or made a false start.false starts can be considered as error corrections. These findings are consistent with the view that stuttering in 'non-stutters' reflects a process of error correction. False start, repetitions and prolongations can be explained under an error correction view. False start, repetitions and prolongations increased with derivational complexity.
(complexity level 1 : zero
complexity level 2 : 4 occurrences
complexity level 3 : 4 occurrences
complexity level 4 : 6 occurrences) , and occurred mainly with past rather than present tense stimuli (12 versus 2), and mainly irregular rather than regular verbs (14 versus zero).

Regularization

Regularizations were scored whenever subjects mistakenly added suffixes to irregular verbs :

lend , beat , seek , swim , set , rid , put
lended, beated,seeked,swimmed, setted,ridded, putted.

In the data above, regularizations always followed appropriate rules for regular suffixation, for -/t/ was not added to stems ending in voiced segments.Regularizations occurred mainly with present tense rather than past tense stimuli (4 versus 0).In fact, there were no instances of ' over regularizations' (addition of regular past tense morphemes to irregular past tense forms e.g.,lost, losted).

Regularizations were significantly more frequent for complexity level 0 than for levels 2 to 4:

Complexity level 0 : 4 regularizations
Complexity level 2 : 2 regularizations
Complexity level 3 : zero regularization
Complexity level 4 : 2 regularizations.

General discussion and conclusion

In general, the error data support the derivational hypothesis rather than the whole-word hypothesis as the mechanism for recalling past tense forms at the phonological and semantic levels. The whole-word hypothesis cannot explain the error data.For example, it cannot tackle regularizations such as (swim, swimmed) since forms such as 'swimmed' do not appear in the internal lexicon and in all likelihood were not encountered by subjects. Such a speech error is not surprising even if it is a highly frequent verb. Also, it cannot be attributed to the view that in foreign language learning, the crucial question is whether the learner knows the word at all and not the mechanism for storing or recalling it.This is because native speakers produce similar speech errors as reported by , for example, Fromkin and Rodman (1993,p.467),'she gived it away' or by Fromkin and Ratner (1998,p.326),'he swimmed in the pool','I knowed about it'.
Such tongue slips reveal that speakers , native or non-native, apply an incorrect regular past tense rule to irregular verbs.

Also, the whole-word hypothesis cannot explain why regularizations took place mainly with present tense level 0 verbs.Moreover, it fails to explain why nontransformations were more common for present than past tense stimuli, or why misinflections only involved inflectional affixes and not, say, nominalization affixex (e.g., ride, rider).

The derivational hypothesis can explain the error data.Partial alternations suggest that various phonological operations for the same stem are, to some extent, independently specified.It seems that alteration rules apply sequentially, so that partial alterations reflect incomplete or partial specification of the sequence of phonological operations (due to haste or other factors).

The derivational hypothesis can explain misinflection, nontransformation

and mistransformation errors as results of rule misapplications. Mistransformations are readily explained as misapplications of alteration rules appropriate for other lexical items. Under the derivational hypothesis, misinflections reflect application of inappropriate verb inflection rules. Thus, not just any suffix was added in misinflection errors because subjects were applying inflectional rather than derivational rules, such as nominalization.

Nontransformations (e.g.,run,run) may also reflect rule misapplication whereby subjects misapplied to other irregular verbs the null alternation rule appropriate only for level 0 verbs such as (put,put). According to this hypothesis, subjects producing nontransformations processed stimuli such as 'run' as present and irregular, but simply applied the wrong alternation rule for forming the past tense form. This hypothesis explains why nontransformations were more frequent for present than past tense verbs, and more frequent for irregular than regular verbs.

The derivational hypothesis can also explain regularizations as due to misapplication of rules for regular past tense formation, but it remains to explain why level 0 verbs such as 'bet, set' were more susceptible to regularization than other irregular verbs. This is not because level 0 verbs end in alveolar consonants (/t/,/d/) since subjects did not regularize other verbs such as 'sent' ending in an alveolar consonant. The reason must be that subjects failed to recognize that level 0 verbs were irregular , which suggests the possibility that level 0 verbs may be stored without lexical features such as [+irregular], and are, in fact, the most primitive verbs at the lexical as well as phonological levels.in other words, subjects may produce level 0 verbs in the present tense form unless situational or deictic context such as an adverv of time (e.g., yesterday) specifies otherwise. These contextual features would serve to block application of subject agreement rules, giving 'He beat his son yesterday' rather than 'he beats his son yesterday'. The features [+past] or [+irregular] are not

necessary for producing level 0 past tense forms according to this hypothesis.

To summarize, the error data can be explained under the derivational hypothesis as due to either misapplication of inappropriate alternation rules or incomplete application of appropriate alternation rules.

Suggestions for further research and pedagogical implications

Apparently, this paper has revealed that further research on how learners of English as a foreign language acquire,store and access multimorphemic words is needed.It is hoped that such research may clarify fully the differing processes language learners undergo in their quest to acquire and use multimorphemic vocabulary items.This clarification is essential before any definitive claims regarding the efficacy of a particular teaching method can be made.

Despite continuous disagreement among researchers and language teachers on the best teaching method to meet the linguistic needs of foreign language learners, an important direction for further research will be to determine at what point during language learning and under what conditions complex words are presented.Such initiatives may further benefit from a close examination of some research questions and pedagogical issues such as:

a- Do the assumptions about storage and retrieval of complex words hold across several languages? What other hypotheses can be posited about lexical representation and access?

b- Is the process of acquisition,storage and retrieval of multimorphemic wordsuniversal in nature?

c- What are the linguistic and cognitive variables that ifluence acquisition,storage and retrieval of suffixes?

d- How do we obtain a more reliable account of the lexical processes underlying suffix acquition,storage and access?

e- What are the theoretical and classroom implications for the teaching and learning of multimorphemic words in English?

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