All Israel

will worship

Why look at many languages?

In order to implement such functions, it is necessary to understand which morphological processes take place in a variety of languages and generation, part-of-speech determination etc.

Almost all natural language applications require some structure of words.

Morphology is the area of linguistics which studies the

Morphology
[dibberu] is ungrammatical.

is reduced to a schwa. This reduction is mandatory, as

in the inflected form जहाँ, the vowel [e] of the base [dibber]

the base जहाँ [dibber]

this form is obtained by concatenating the suffix 1 [u] to

जहाँ is third person, plural, past form of the verb जहाँ

Observations:

नजारा नजारा नजारा on

Example
In the example, the vowel [e] is shortened to a schwa.

Interaction of morphology and phonology

might be a word). an affix (which is not a word) to the end of a base (which

in the example, the final form is obtained by concatenating

How morphology encodes information?

number and tense. in the example, morphology encodes details such as person,

What information is encoded by morphology?

These simple observations shed light on a variety of issues:

Example
Interaction of morphology and phonology

pattern, replication
concatenation, infixation, circumfixation, root and

How morphology encodes information

What information is encoded by morphology

Infixation and derivation

Structure of this part of the course
form. Example: Latin

 Intellectual: Distinct features are merged into a single bound

Expressed morphologically. Example: Yupik (central Alaska) in other languages (such as arguments of the verb) are 

Polythetic: Elements that often occur as separate words

Example: Turkish

Word-like beads on a string

Agglutinative: Bound forms occur and are arranged in the

Isolating: No bound forms. Example: Mandarin Chinese

Three types of languages
Isolating Languages

No bound forms. Example: Mandarin Chinese

does don’t like to eat vegetables

the does didn’t like to eat vegetables

the does don’t like to eat vegetables

the does didn’t like to eat vegetables

the does doesn’t like to eat vegetables

Can mean any of the following (inter alia):

does not like eat vegetable

Gōu bù ěr chī qíngezì
Was it from those that were in our Garbage can?

Garbage Aff Pl Ip/Pl Loc Rel Pl Able In the past
Cop like her imiz de ki ler den mi y di

Göplichlerimizdeki de borsudaklarmi di!

Beads on a string. Example: Turkish

Agglutinative Languages
The grammar is in the morphology

he was excellent at making kayaks
Kayaks make excellent he Past

gayə: yən:i, n:i

gayə: iy:i, n:i

syntactic (as in noun incorporation). Example: Yupik
morphology encodes units that are usually considered

Polythetic languages
love tp/5g/Pres/indicative/Active

6 am

6 am

various bits of information. Example: Latin

Portmanenteal morphemes: a single morpheme can encode

Infectionsal languages
are all inflected forms of a single morpheme. Words which belong to the same paradigm forms of a word. Hence: words have paradigms, defining all possible inflected third person plural and the tense is past. The output is appropriate to a context in which the subject is.

Example: [dibber] ↔ [dibbru]

Inflectional morphology takes as input a word and outputs a

Inflections and derivations
Example: ยศภูษณ์ ภูษณ์ ภูษณ์ ภูษณ์ ภูษณ์
Example: establish+ment+ary+an+ism
called word formation.
a different word that is derived from the input. This is also
Derivational morphology takes as input a word and outputs a
Inlections and derivations
by inflectional morphology is productive. In other words, the relation denoted
all appropriate words. In other words, the relation denoted
If a language marks an inflectional category, it marks it on
never is.
Inflection is sometimes required by the syntax, derivation
Inflection is sometimes required by the syntax, derivation
might.
Inflection does not change the part-of-speech, derivation
Inflections and derivations – distinctive criteria
Example: causativization
Cicero is praised
Cicero laudat
the boy praises Cicero
boy Cicero laudat
Cicero (Latin)

lexically specified markings.

Verbal morphology.

Verbal morphology.

Examples:

verbs specify the number (and type) of arguments they may

Natural Language Processing
The man has praised Cicero

man Cicero praise\textsubscript{3} /\textipa{x}/Pert/Ind

vir Cicernem Laudavit

The man will praise Cicero

man Cicero praise\textsubscript{3} /\textipa{x}/Future/Ind

vir Cicernem Laudabo

Example: Latin

and aspect respectively.

and aspect respectively.

and aspect respectively.

such markers encode tense of completion of the situation. Such markers denote the situation which the situations denoted by them occurred, or the state at which the situations occurred. Indications of the time at which the situations occurred are commonly marked with indications of the time at which the situations occurred. Indications of the time at which the situations occurred are commonly marked with indications of the time at which the situations occurred.

Verbal morphology
In some languages (e.g., Georgian and Chichewa) verbs agree not only with their subjects but also with their objects.

* "The princess kisses the frog"

Example:

In many languages the verb must agree on person, number, gender or other features with one or more of its arguments.

Verbal morphology
Example: the inflection paradigm of the noun magnus (big) in Latin.

- Latin has five cases: nominative, genitive, dative, accusative, ablative.
- Gender (feminine, masculine, neuter)
- Case (marking various kinds of semantic function)
- Number (singular, plural, dual)

Inflectional categories for nouns (and adjectives) include...
The inflection paradigm of Latin magnus

<table>
<thead>
<tr>
<th>Singular</th>
<th>Plural</th>
<th>Case</th>
<th>Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>masc.</td>
<td>fem.</td>
<td>neut.</td>
<td></td>
</tr>
</tbody>
</table>
inter alia.

objects, paired things, instruments and extended body parts.

Example: Swahili has inflectional affixes for humans, thin

gender classes exist.

In some languages, such as the Bantu languages, more detailed

genders; feminine, masculine and neuter.

Many languages distinguish between two or three grammatical

Nominal morphology
Adjective morphology

Many languages express comparison of adjectives

Example: Welsh

dwyarn + ed = dŵr
white

dwyarn + ach = dŵrach
whitest

tec + ed = tec

fairer

tec + ach = tec + ar

fairest
\begin{itemize}
\item Negation: able $\rightarrow$ unnable, able
\item Deverbal adjectives: drinkable $\rightarrow$ drankable, drinkable; $\rightarrow$ drinkable
\item Derivational morphology: not as productive as
\item Inflectional morphology.
\end{itemize}

In general, derivational morphology is not as productive as

Derivational morphology
In German, the concatenation is expressed in the orthography:

Both lemmas might undergo modification in the process.

Example: policeman, newspaper, company, insurance, employee, leben's Vertriebsangebot

In compound nouns, two or more lemmas are attached to a stem, in contrast to derivations and inflections, where affixes are

Compounding
Garbage Aff Pl Ip/tp Loc Rel Pl Ap/Ab Imit Aux Past
gıp İl àr ı̀mìz de Kì ler dén mi à y di
cöp plicine mizdekkle demmiyldì.

Turkish words are of the form stem suffix.

Example: Turkish. Not only is Turkish morphology

morphemes concatenated together.

morphologically complex word can be analyzed as a series of

The simplest model of morphology is the situation where a

what ways they are expressed.

In order to know what morphemes are, it is useful to check in

What are morphemes?
enemy be an enemy

friend \leftarrow f+nm+nsnl

red be red

killed \leftarrow k+nm+llad

strong be strong

ticks \leftarrow f+nm+llkas

Example: Bonito (Philippines)

Inside words, put morphemes together. Affixes may also attach as infixes. Linear concatenation is not the only way in which languages

What are morphemes?
their dog
your (pl) dog
our (exclusive) dog
our (inclusive) dog
his/her/its dog
your (sg) dog
my dog

Example: ãlia (Nicaрагua)

Principles:
In general, the placement of infixes is governed by prosodic consonant of the word to which it attaches.
In the Bontoc case the infix must be placed after the first.

What are morphemes?
Example: German participles
discontinuously around a stem.

Some languages exhibit circumfixes, affixes which attach

What are morphemes?
Example: Hebrew binyanim

What are morphemes?
What are morphemes?
37z \rightarrow 37z \quad \langle \text{root} \leftarrow \text{ADJ} \quad \langle \text{N, state of}, \ ('	ext{state of}'), \ ('\text{state of}'), \ (\text{state of}) \rangle \rangle

\text{Example:}

form, including the ways in which it is attached to its stem. And PHON represents its phonological semantic features), and PHON represents its phonological expressed by the morpheme (for example, its syntactic and category pair \langle \text{CAT, PHON} \rangle, \ where \ CAT \ is \ the \ morphological \ category \ in \ its \ most \ general \ definition, \ a \ morpheme \ is an ordered phrase. So, what are morphemes?}
any of these.

Furthermore, the orthographic word might not correspond to
notions specifically overlapping but not identical sets of entities.

view: phonological words and syntactic words. These two
are really two kinds of words from a structural point of

It is a fairly traditional observation in morphology that there

morphological. The two structures are not always isomorphic.
to assume that words have dual structures: phonological and

What are words, then?
Word boundaries. It is better to produce a list of phonemes without determining the form of the verb (7272) or as a structure tree; sometimes it either as a list of features (7272), sometimes morphological information is needed, sometimes it is sufficient to know that 727 is an intelected.

The answer depends on the application:

Analyzer produce?

What information should a morphological...
Various kinds of such constraints are known. Morphotactics investigates the constraints imposed on the order in which morphemes are combined.

Example:

but

\[ \text{a} \rightarrow \text{a} \rightarrow \text{a} \]
before “native” ones:

• Other constraints: in English, “Latin” affixes are attached
  [ut] converts an adjective to a noun
  [i] converts a noun to an adjective,

• Syntactic constraints: [s] converts a noun to a preterite

• Suffix

• Constraints on the type of the affix: [v] is a prefix, [v] is a

Types of constraints:

Morphotactics
orthographic ones. Since most computational analyses of morphology assume written input, phonological rules are often confused with constructing computational models of morphology is spent on developing techniques for dealing with phonological rules. A great deal of the effort in effects of phonological rules. Things are not that simple because of the often quite drastic decomposition. Determine the meaning of the resulting decomposition. Ideally, the task of a morphological analysis system would be

Phonology
baking ← baking (and not *bakeinge)
city+5 cities (and not *city5)

Phonology

An orthographic rule that does not correspond to any
rules.

Orthographic rules often do not correspond to phonological
Grammaratical → Grammatical

Orthography:
A phonological rule (stressed shift) is not reflected in the

Divinity ← Divinity

The orthography:
A phonological rule (changing [a] to [i]) is not reflected in

Phonology
Phonology