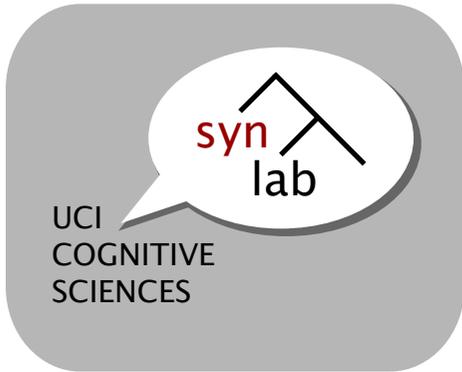# PSYCH 155/LING 155

# Psychology of Language

Prof. Jon Sprouse

Lecture 14: Morphological Decomposition

What do we know about Lexical Access?

Cross-modal priming and neighborhood density effects suggest that we use the processes of generation and selection to use the **phonetic form** to access lexemes from the lexicon

The frequency effect suggests that the lexicon is organized by **frequency**

Semantic and mediated priming suggest that the organized by **semantics (meaning)**
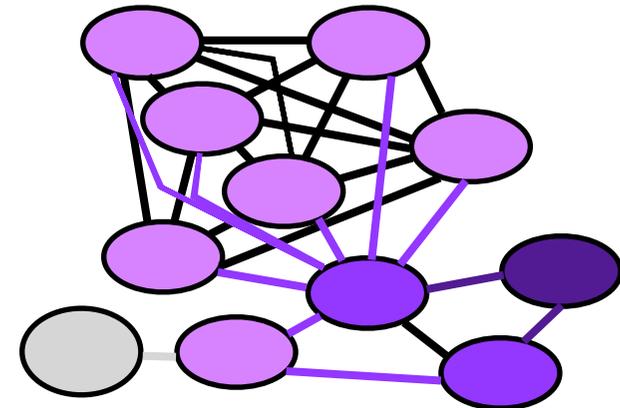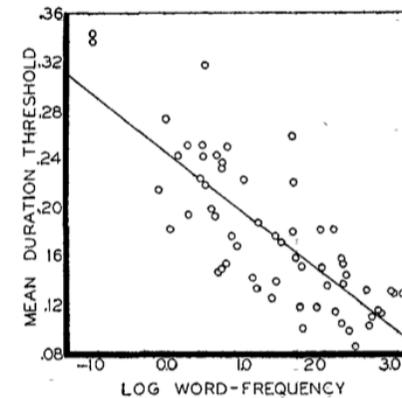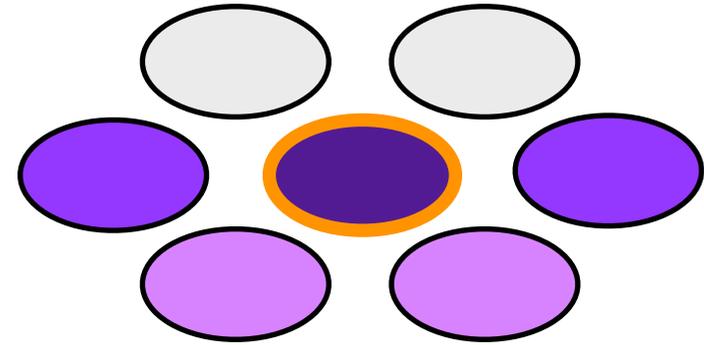
But what about computation of complex words from morphemes?

Remember that we concluded that LF plurals are computed from constituent morphemes during lexical access:

Dual Route Hypothesis: Singulars and HF plurals are stored, LF plurals are computed

This is a middle ground:
medium memory cost and medium
number of computations

| kitchen | window |
| s | windows |

This means that pure phonetic-based access can't e entirely correct: the system must break incoming words down into constituent morphemes in order to access the individual morphemes and compute LF plurals.

Morphological Decomposition is the process of decomposing an incoming word into its (potential) constituent morphemes.

Morphological Composition is the process of combining morphemes to create a complex word.

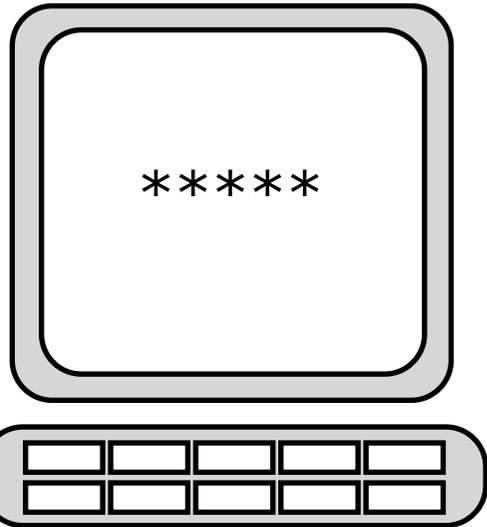# So how can we look for evidence of morphological decomposition?

Morphological Decomposition is the process of decomposing an incoming word into its (potential) constituent morphemes.

The dual-route model suggests that there must be an early stage of lexical processing when the incoming word is decomposed into (potential) constituent morphemes.
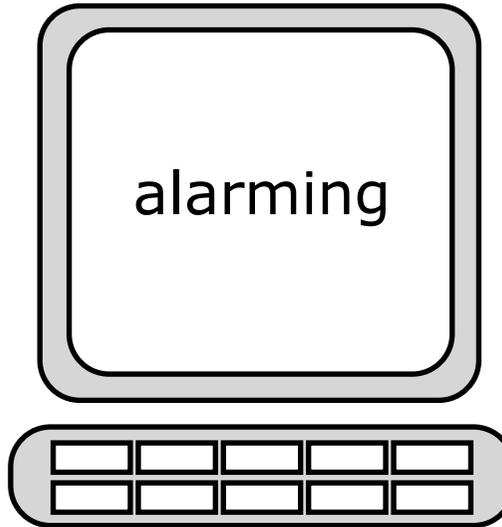
The problem is that this stage will be **very early** in the process, well before lexical access happens (<200ms), so late measures like lexical decision times (~500ms) are not well-suited to detect morphological decomposition.
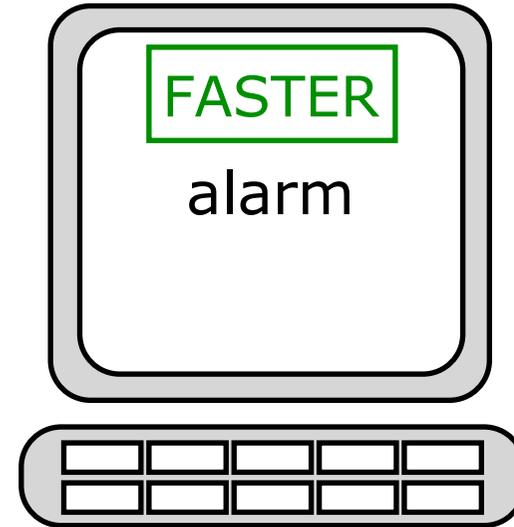
Masked Priming

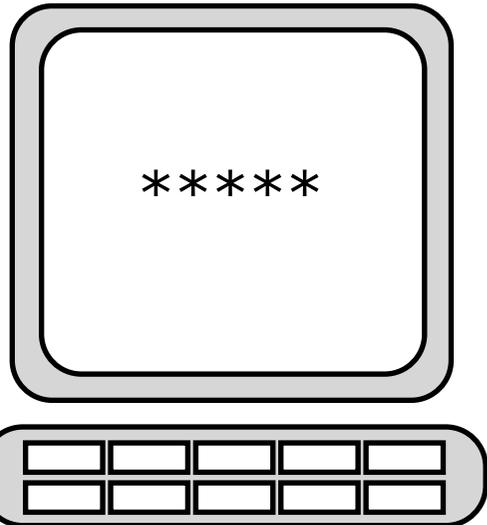| 500ms	< 50ms	decision
mask	prime	target

| ***** | alarming | FASTER alarm |

The prime is too fast to be consciously visible, so any effect that it has is purely based on early, automatic processing.

Under the dual-route model, we expect all incoming words to be **decomposed** into (potential) morphemes.
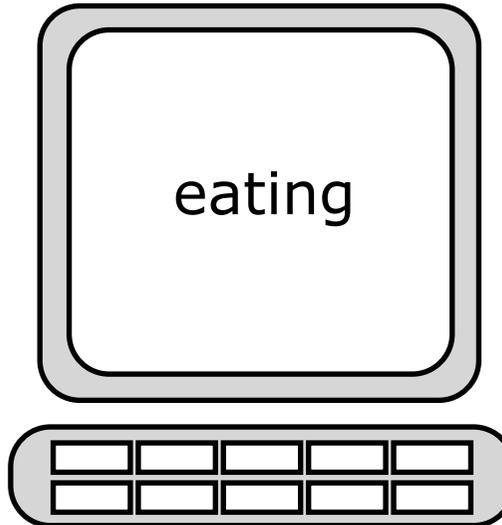
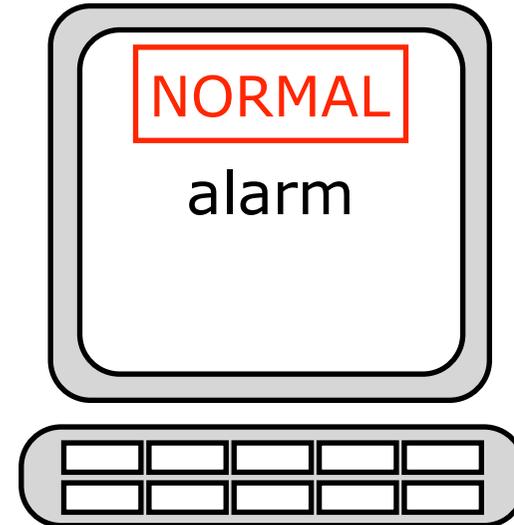Decomposing **alarming** into **alarm | ing** should cause priming of **alarm**!

Masked Priming

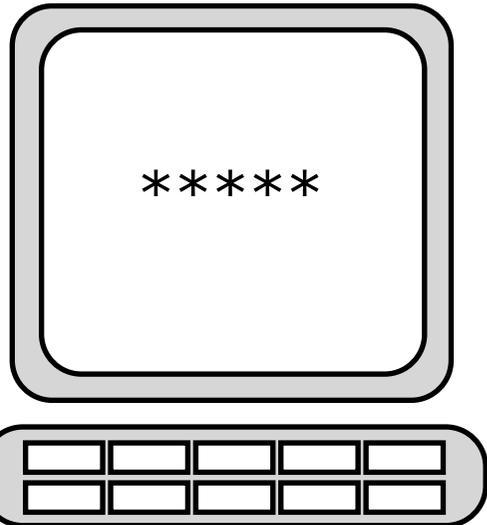| 500ms	< 50ms	decision
mask	prime	target

The prime is too fast to be consciously visible, so any effect that it has is purely based on early, automatic processing.

Under the dual-route model, we expect all incoming words to be **decomposed** into (potential) morphemes.
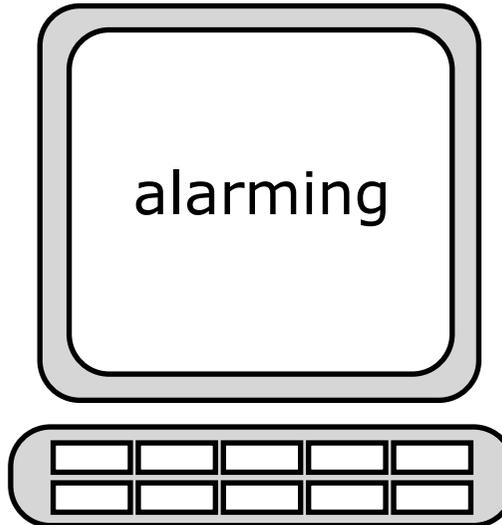
Decomposing **eating** into **eat** | **ing** should **not** cause priming of **alarm**!
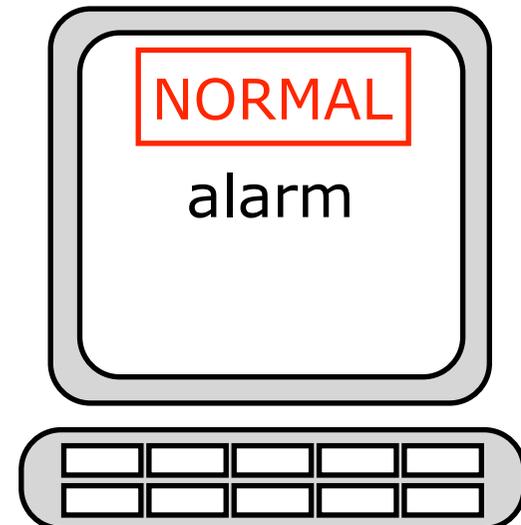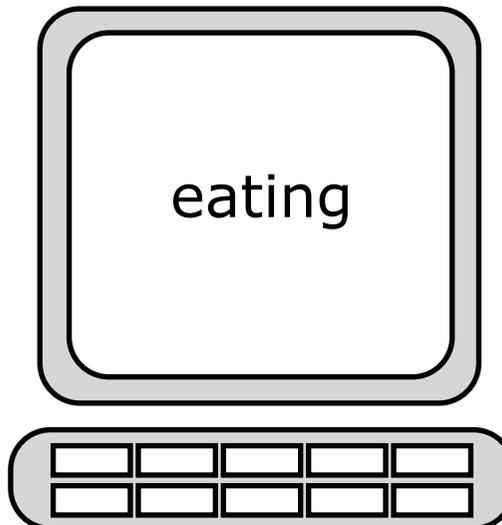
Masked Priming
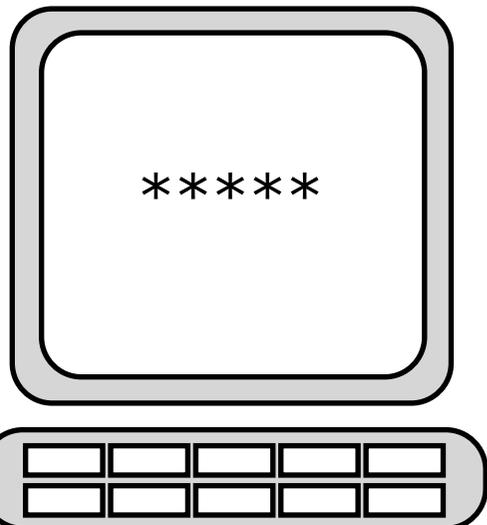
What about this one?

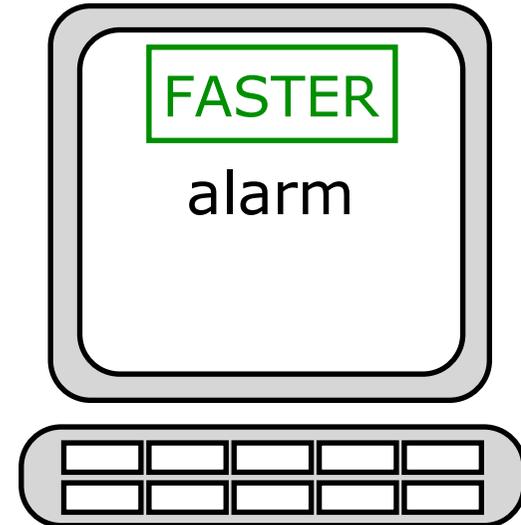| 500ms	< 50ms	decision
mask	prime	target
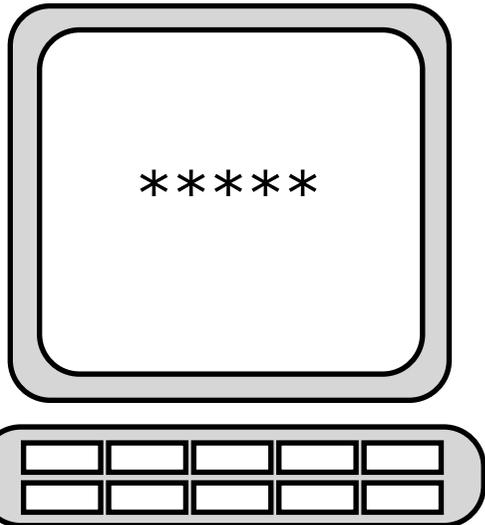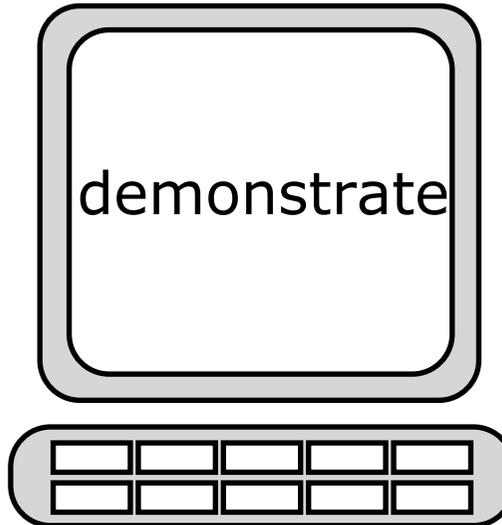
*****   demonstrate   NORMAL demon
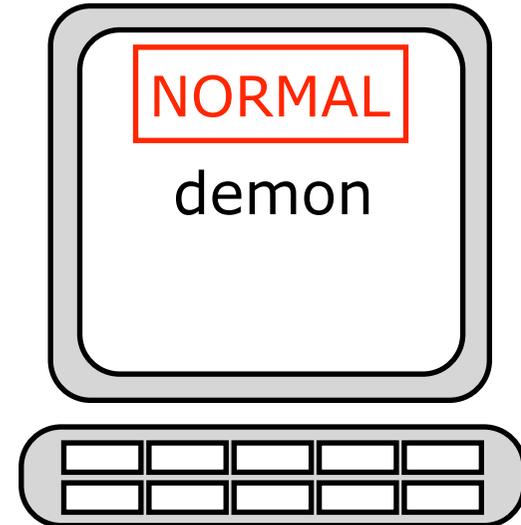
Under the dual-route model, we expect all incoming words to be **decomposed** into (potential) morphemes.

But demonstrate cannot be decomposed into morphemes because strate is **not a morpheme**! So there is no decomposition.

With **no decomposition** of demonstrate, there can be **no priming** of **demon**!

So now we have an experiment!

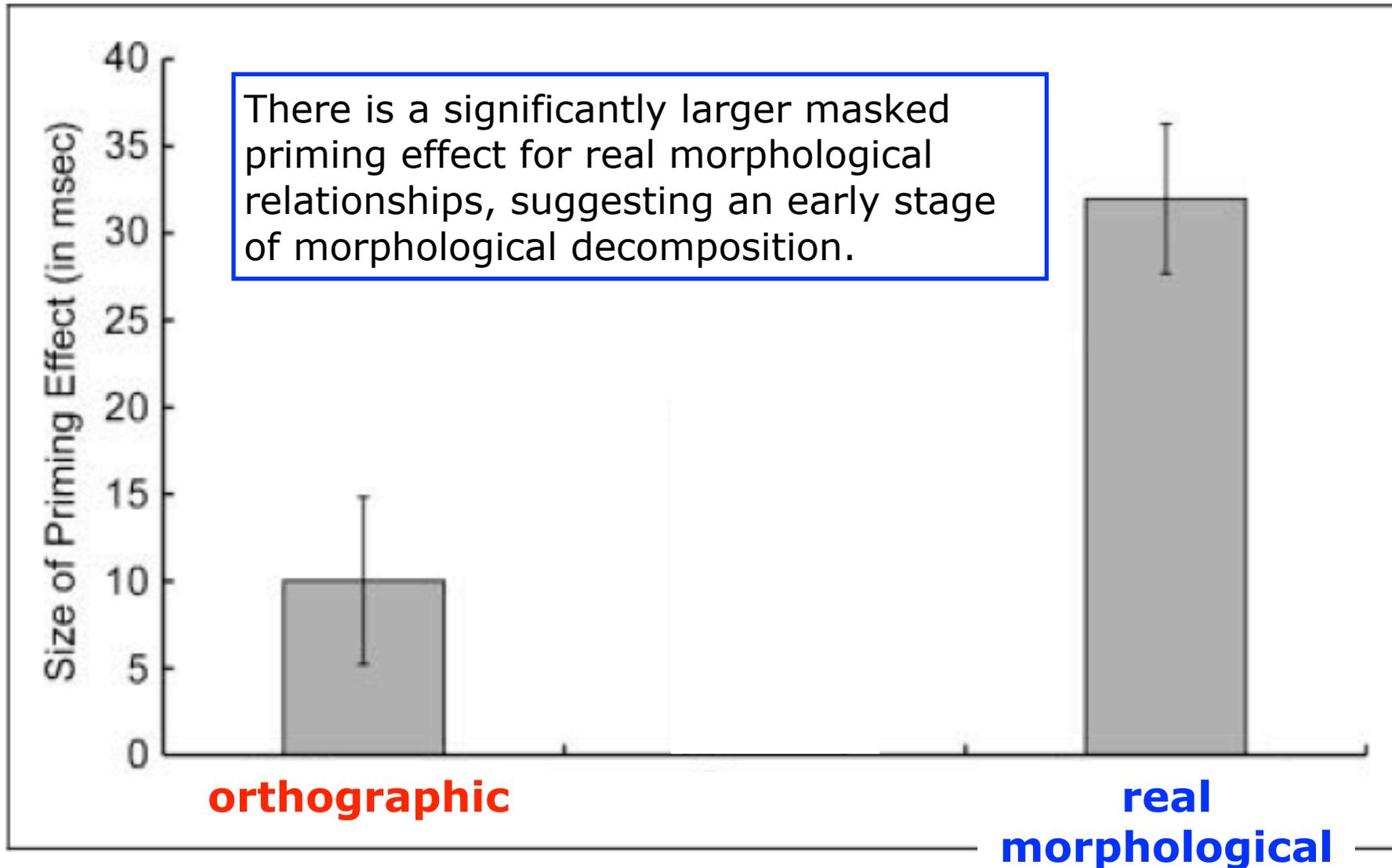| prime	target	relationship	prediction
alarming	alarm	real morphological	masked priming
eating	alarm	none	normal decision
	Why?	alarming can be decomposed into alarm	ing, both are morphemes, so decomposition is triggered, and alarm primes **alarm**.	

prime	target	relationship	prediction
demonstrate	demon	orthographic	no masked priming
eating	demon	none	normal decision
	Why?	demonstrate cannot be decomposed into morphemes because strate is not a morpheme. So decomposition is not triggered, and there can be no priming.	

Results!

There is a significantly larger masked priming effect for real morphological relationships, suggesting an early stage of morphological decomposition.

If morphological decomposition is automatic...

One interesting prediction of the automatic morphological decomposition stage is that decomposition should occur whenever a word **appears to have morphemic structure**, regardless of whether it really does.

The reason for this is that the system cannot know whether the morphemic structure is real or not until **after lexical access is complete!** So at the early stages, it needs to **play it safe** by attempting decomposition on everything that **looks like a morpheme**.

Here is a concrete example:

department   Both depart and ment are morphemes in English. But **department** does not mean the same thing as combining depart and meant. It is **lexicalized** as a single unit.

But the automatic morphological decomposition process occurs before lexical access is complete, so it can't know this, so it has to decompose department into depart | ment just in case!

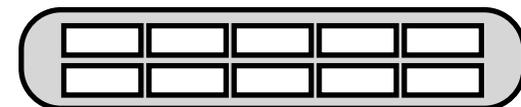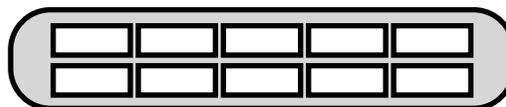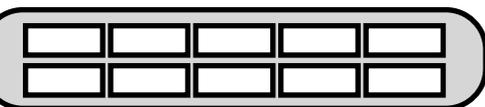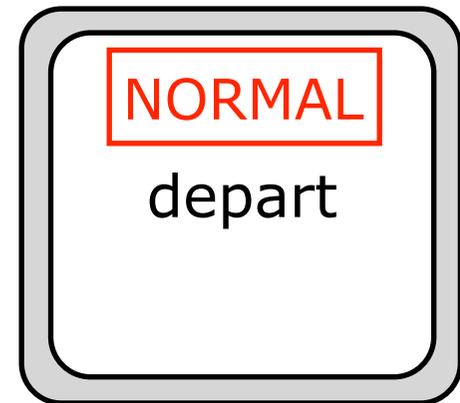# A new prediction:
apparent morphological relationships

500ms   < 50ms   decision

mask   prime   target

***** department FASTER depart

***** eating NORMAL depart

Results!

There is a significantly larger masked priming effect for apparent morphological relationships, suggesting an early and automatic stage of morphological decomposition.
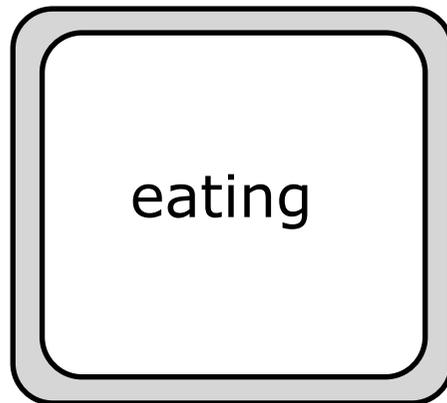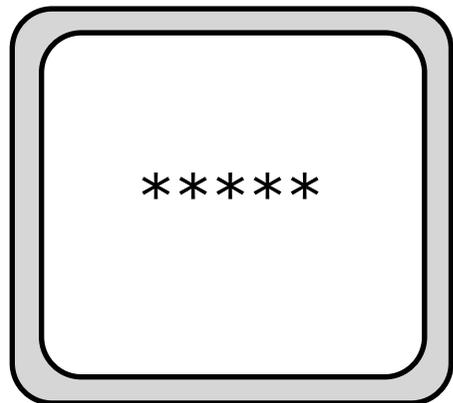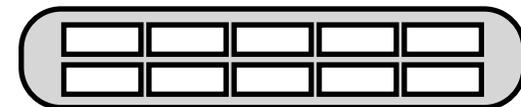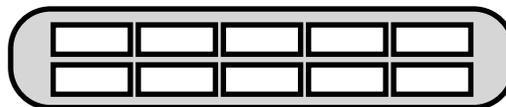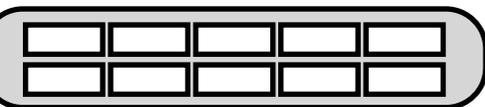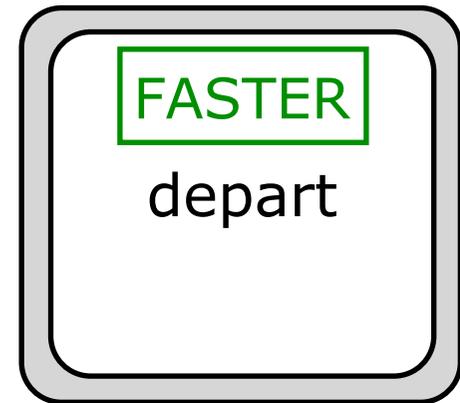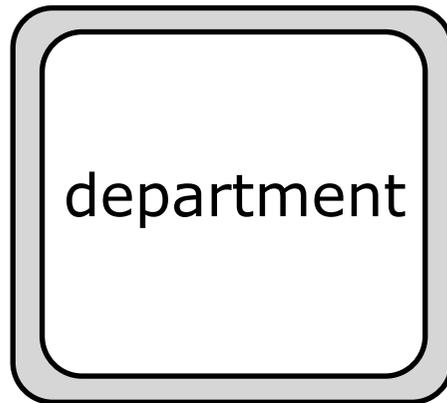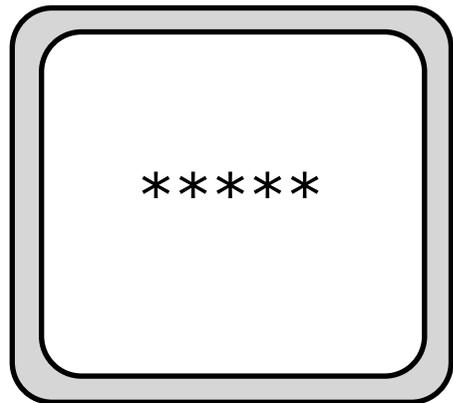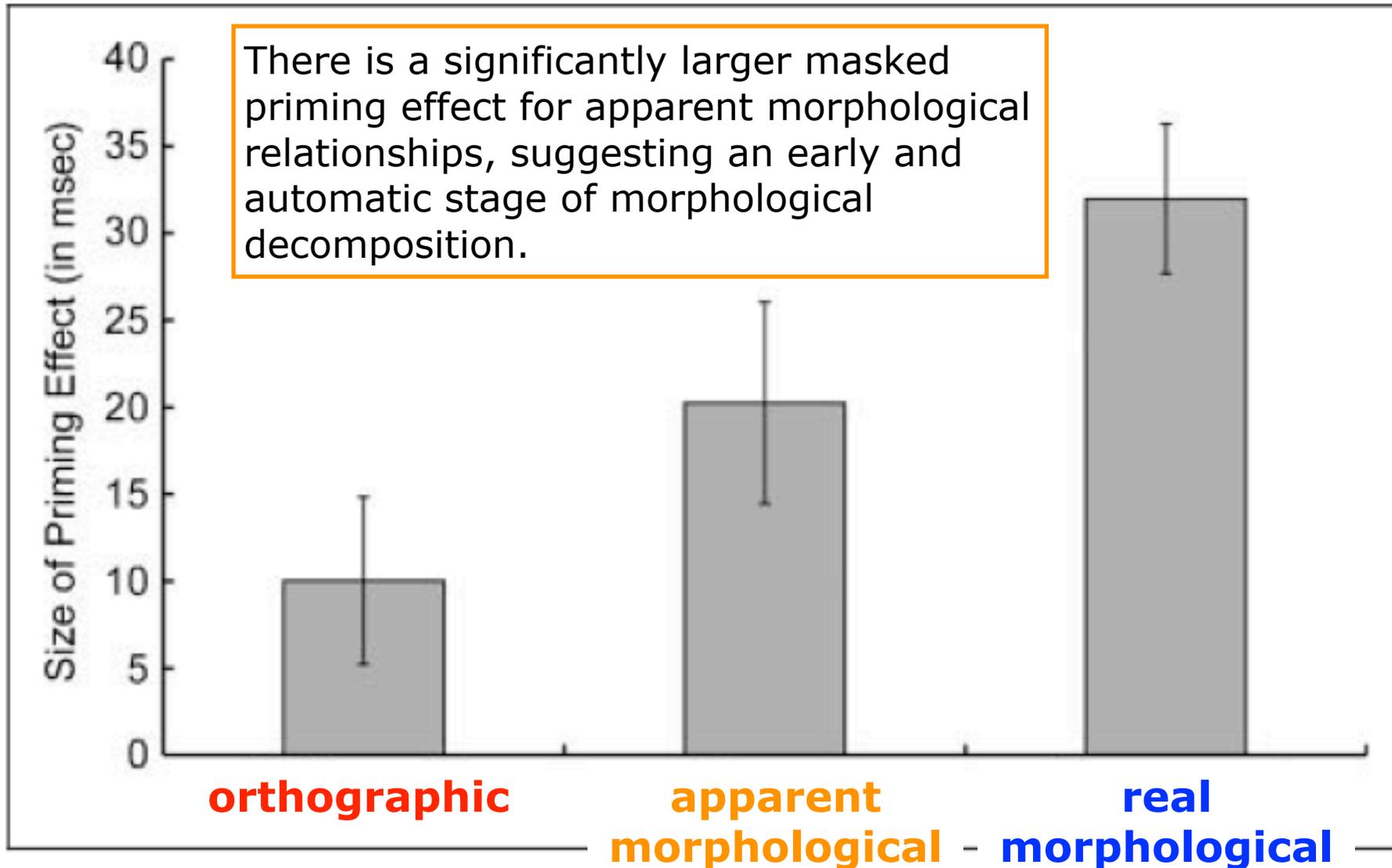
Masked priming summary

prime	target	relationship	prediction
alarming	alarm	real morphological	masked priming
department	depart	apparent morphological	masked priming
demonstrate	demon	orthographic	no masked priming

The explanation: There is an early, automatic process of morphological decomposition. This process must apply to all apparent morphemes just in case they are true morphemes that are necessary for successful lexical access.

Compound words and morphological decomposition

Compound words are words that appear to be composed of other words.

Novel compounds are compounds that you make up on the fly. They tend to have an accent on the second word, and tend to have a fully compositional meaning:

mud cáke

Lexicalized compounds are compounds that have become stored as complete units. These tend to have an accent on the first word, and be written as a single unit:

téacup   cúpcake   flágship

Lexicalized compounds can have transparently compositional meanings, or have less transparent meanings

Decomposition of lexicalized compounds

In looking for decomposition in compounds, it is most interesting to look at lexicalized compounds with non-transparent meanings, as these are clearly stored as a unit.

If we can find evidence of decomposition in these lexicalized compounds, then we will have evidence that decomposition applies for all compounds regardless of their status (just like we saw for dependent morphemes).

The apparent components of flagship are both much more frequent than flagship!

flagship and crescent are equal in <u>length</u> and <u>frequency</u>
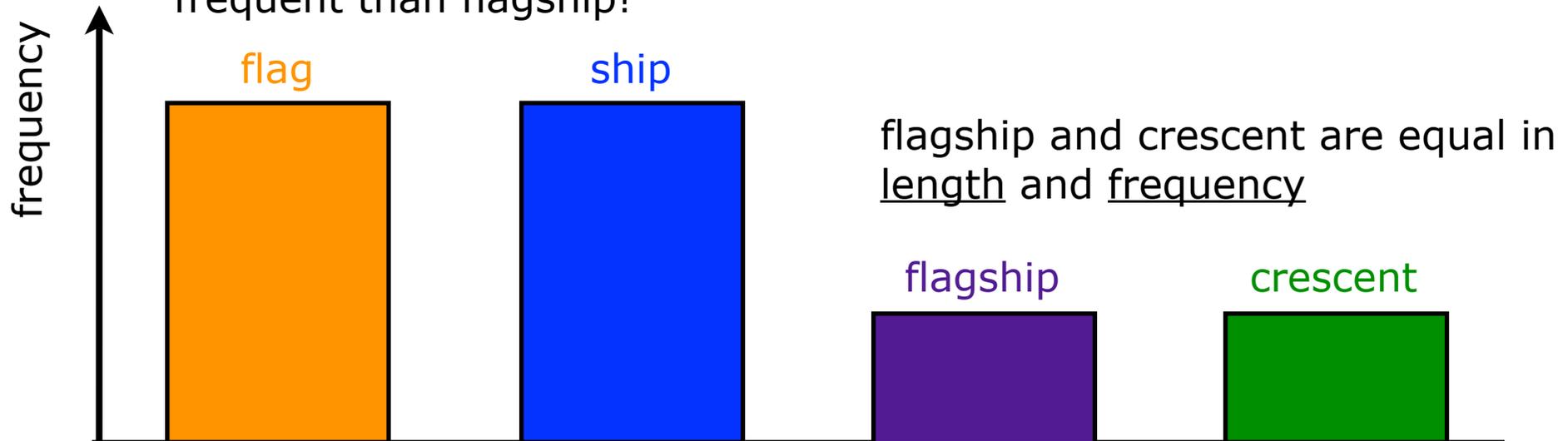
Competing Predictions

If there is **no decomposition** in compounds, the we would expect flagship and crescent to be recognized in an <u>equal amount of time</u> because they have <u>equal frequency</u>.
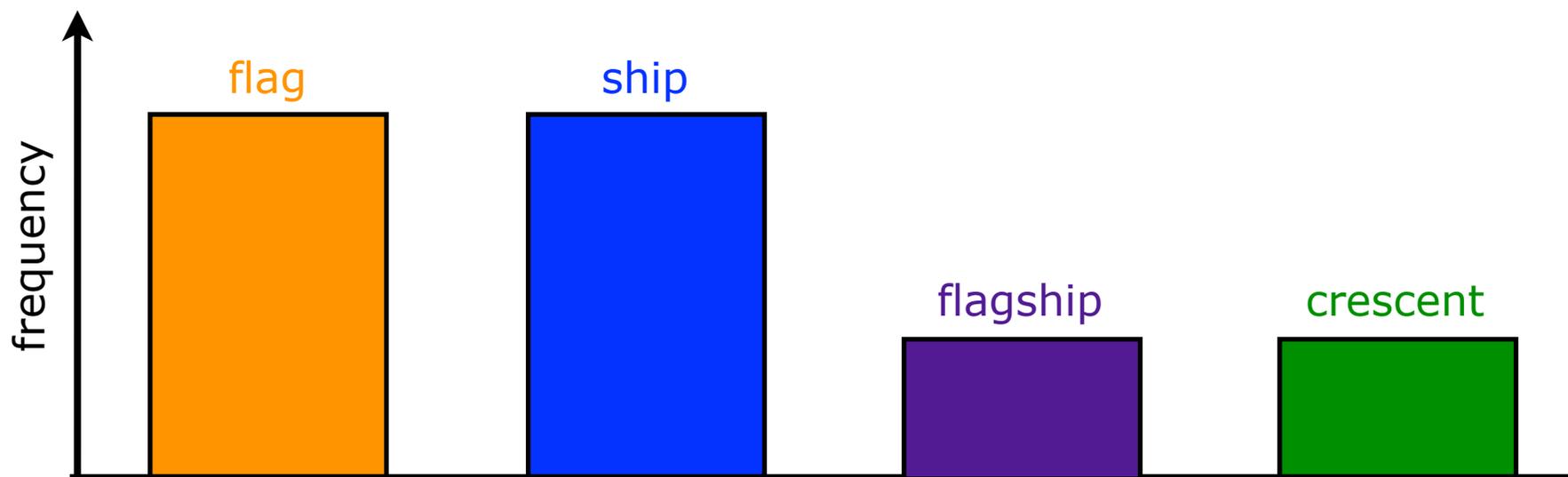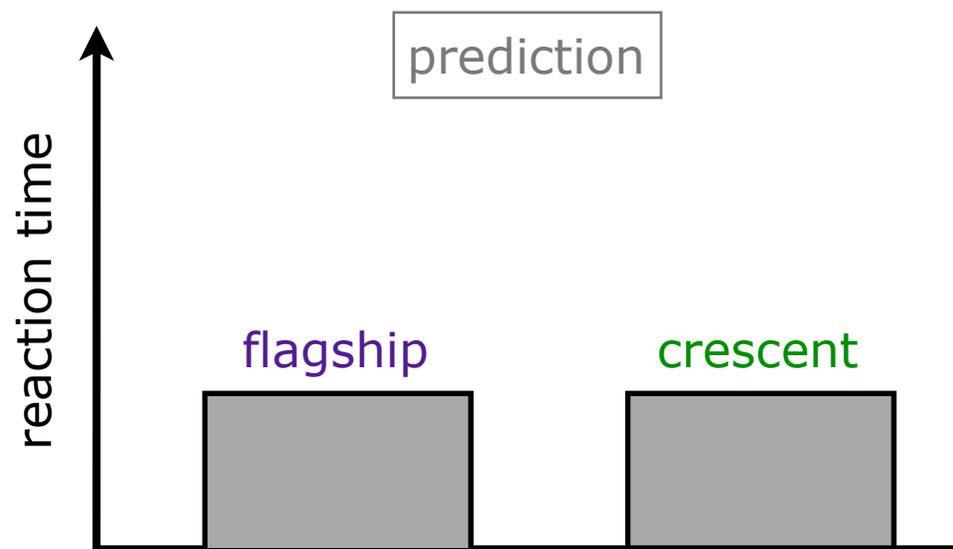
Competing Predictions

If there is **decomposition** in compounds, the we might expect flagship to be recognized <u>faster</u> than crescent because flag and ship are very high frequency, which could aid the activation of flagship (because the the components would be activated early)
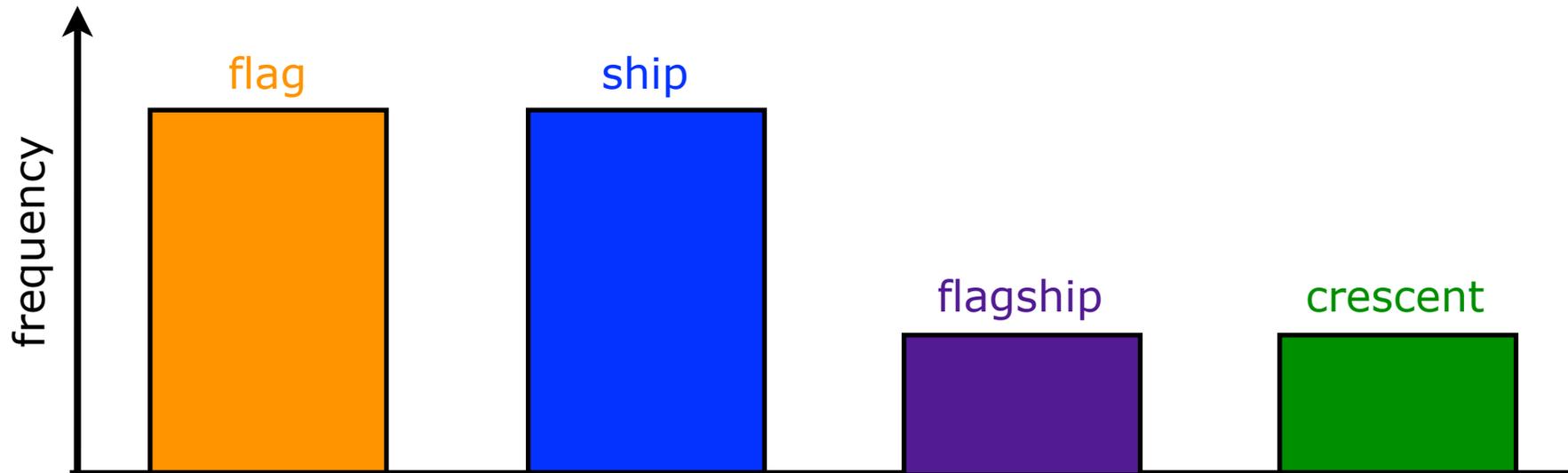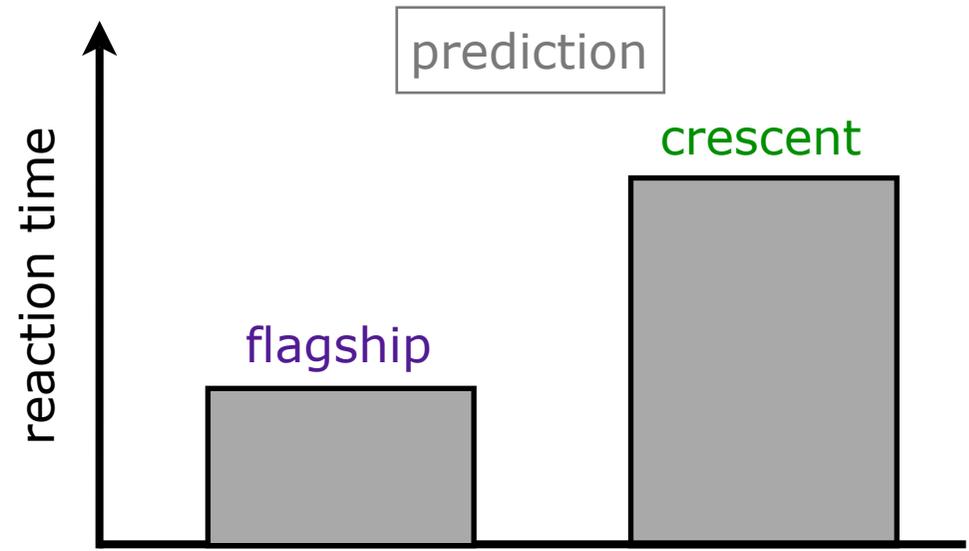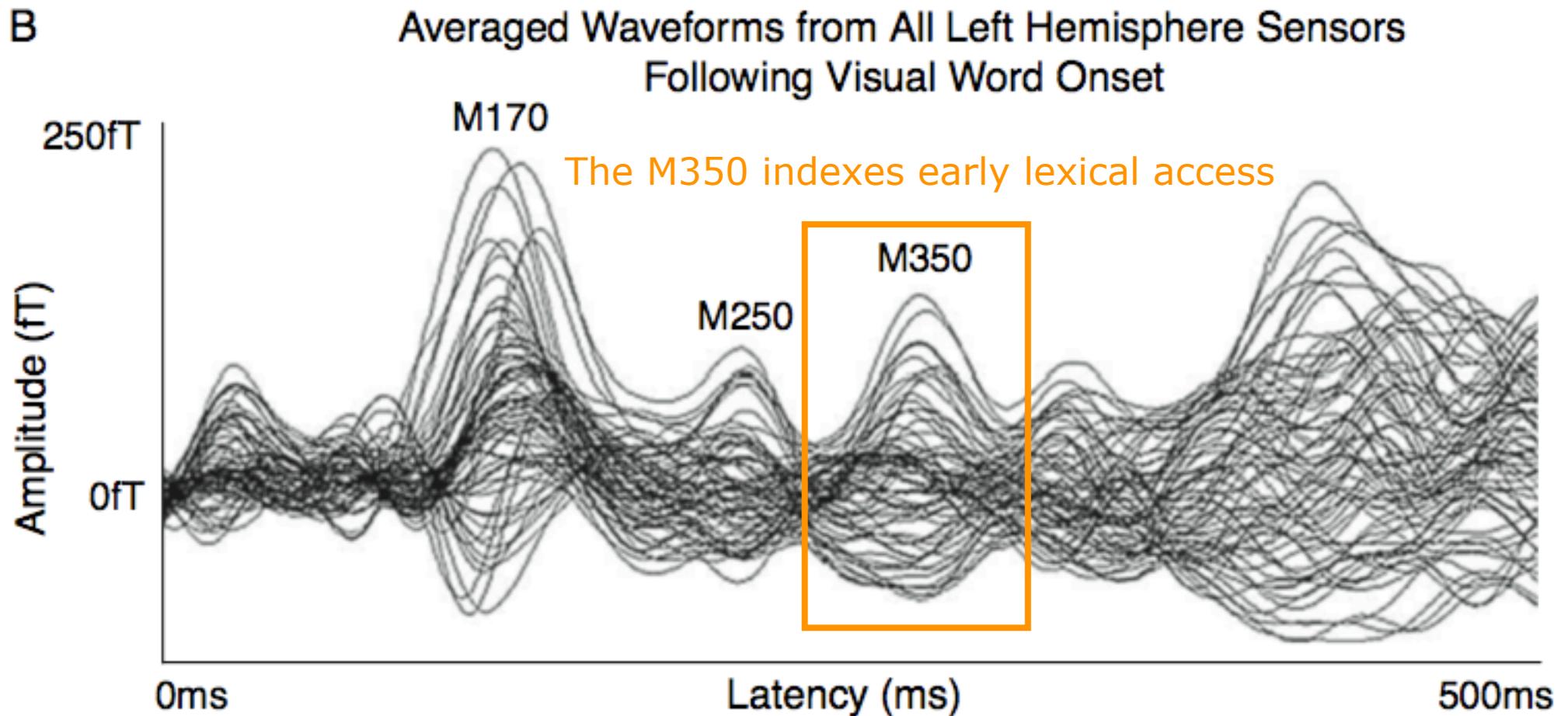
The results

Fiorentino and Poeppel 2007 found that reaction times to flagship are significantly faster than crescent, suggesting that there is morphological decomposition in compounds
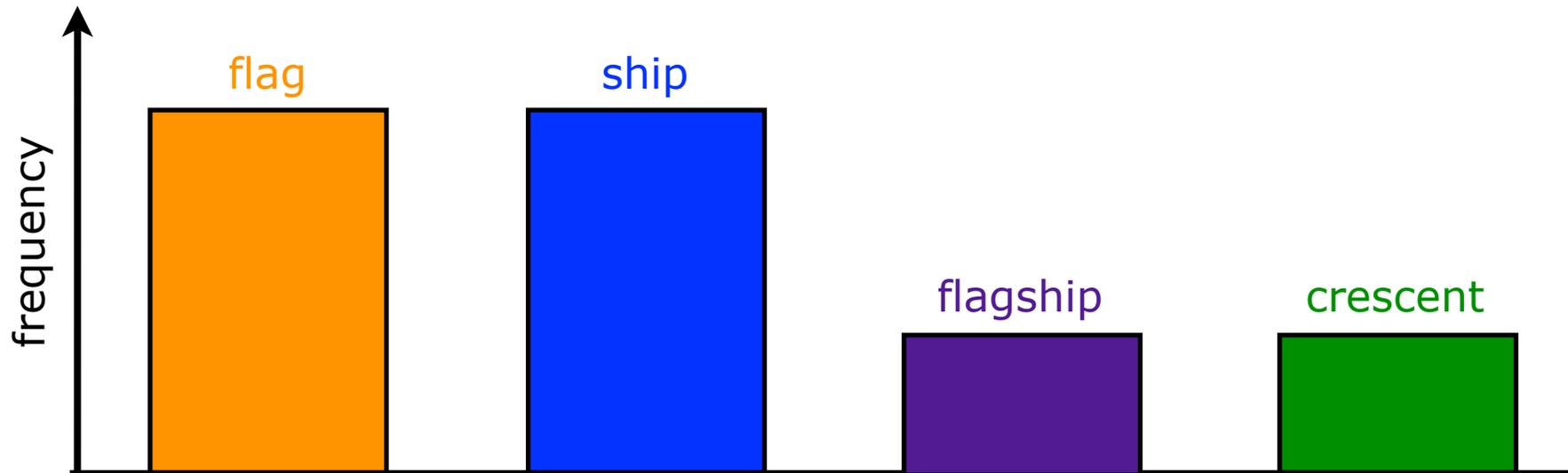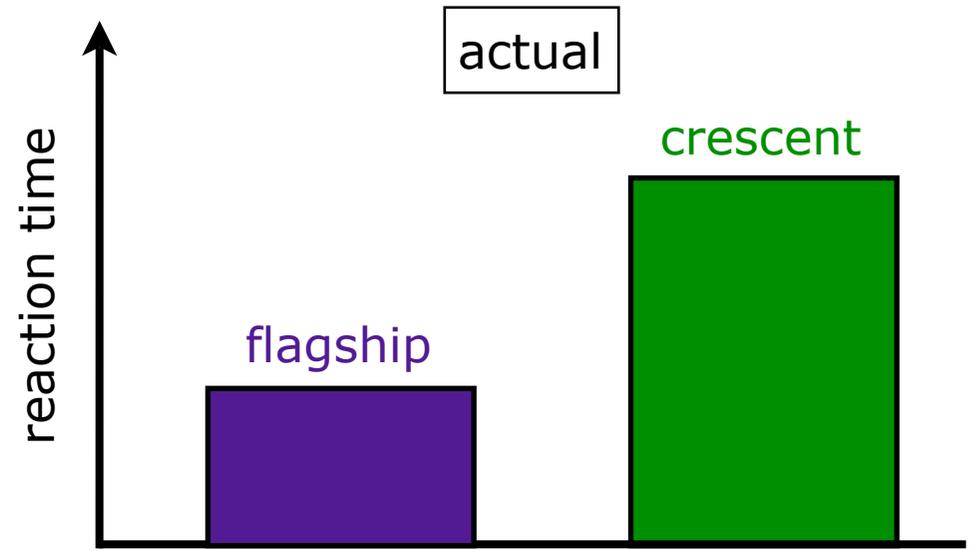
MEG and the M350

There is an MEG component called the **M350** that has been shown to index the completion of **lexical access**.

B

Averaged Waveforms from All Left Hemisphere Sensors
Following Visual Word Onset

M170

The M350 indexes early lexical access

M350

M250

Amplitude (fT)

250fT

0fT

0ms

Latency (ms)

500ms

The M350 is earlier for compounds!

Fiorentino and Poeppel 2007 also found that the M350, which indexes the completion of lexical access, occurs <u>earlier</u> for flagship than crescent.

This confirms that flagship has a lexical access advantage, which can be explained by its high frequency components if morphological decomposition occurs in compounds!
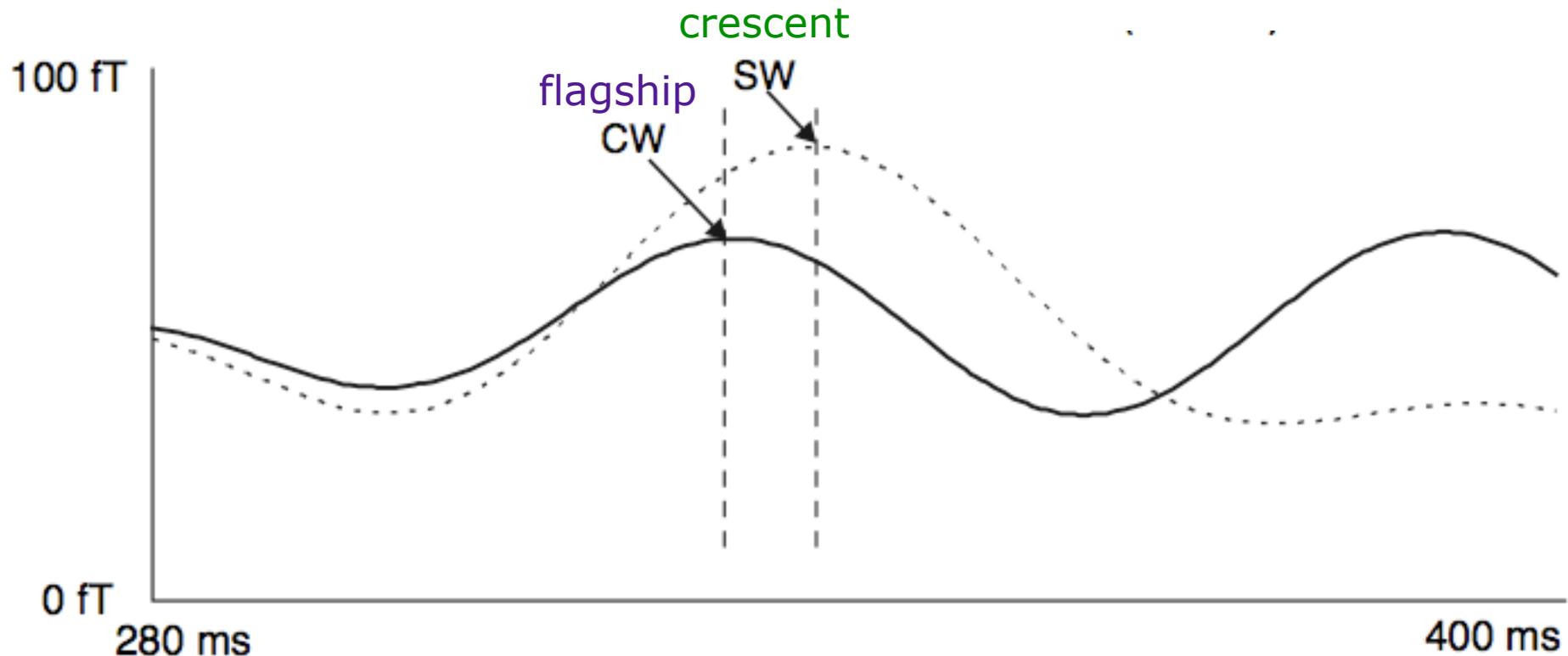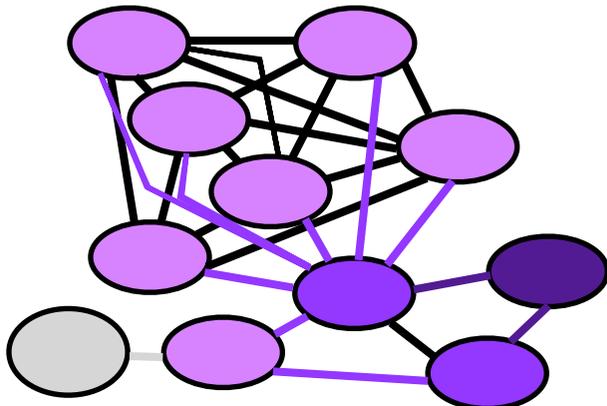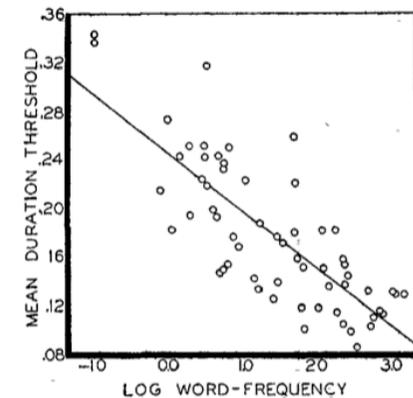
What do we know about Lexical Access?

Cross-modal priming and neighborhood density effects suggest that we use the the **phonetic form** to access lexemes from the lexicon
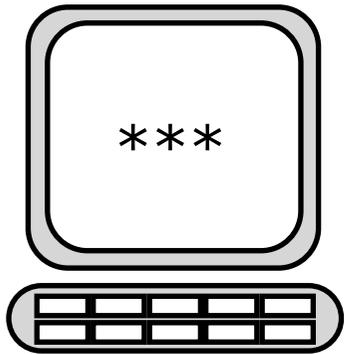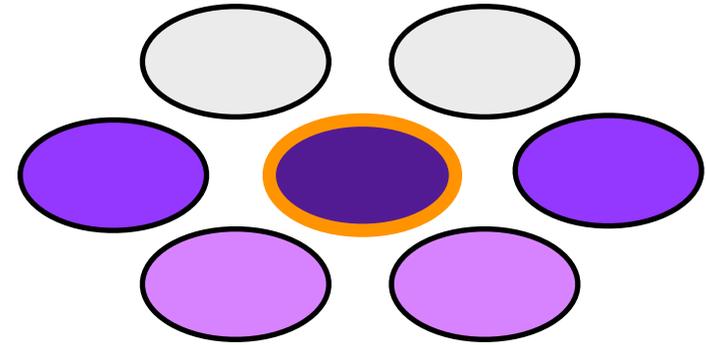
Masked priming and MEG suggest that morphological decomposition occurs automatically in the early stages of lexical access.

The frequency effect suggests that the lexicon is organized by **frequency**

Semantic and mediated priming suggest that the organized by **semantics (meaning)**