

Storage & computation in language production LING 611 Spring 2021

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2/14/2021

Levels of representation

- **Sentences** consist of **phrases**, which consist of **words**, which consist of **morphemes**, which consist of **syllables**, which consist of **phonemes**, which consist of **phonological features**...
- Possible intermediate levels between these levels (e.g., biphones)

Levels of representation: a big question

- Linguistic units are often complex.
- How do we represent and process complex linguistic units?

Storage and computation

- Computation: use combinatorial mechanism to generate complex representations
- Memory: store complex unit as a whole and access them from memory

Storage and computation

- Computation: use combinatorial mechanism to generate complex representations
- The very fact that we can comprehend/produce novel forms (e.g., the wug test)
- Memory: store complex unit as a whole and access them from memory
- We see the effect of experience/frequency with multiple granularity of representations.

Storage and computation

- Higher-order units can be computed “on the fly” by combining lower-order units according to certain set of rules/constraints.
- But higher-order units may be stored as a unit in memory for later reuse as well.

Storage and computation

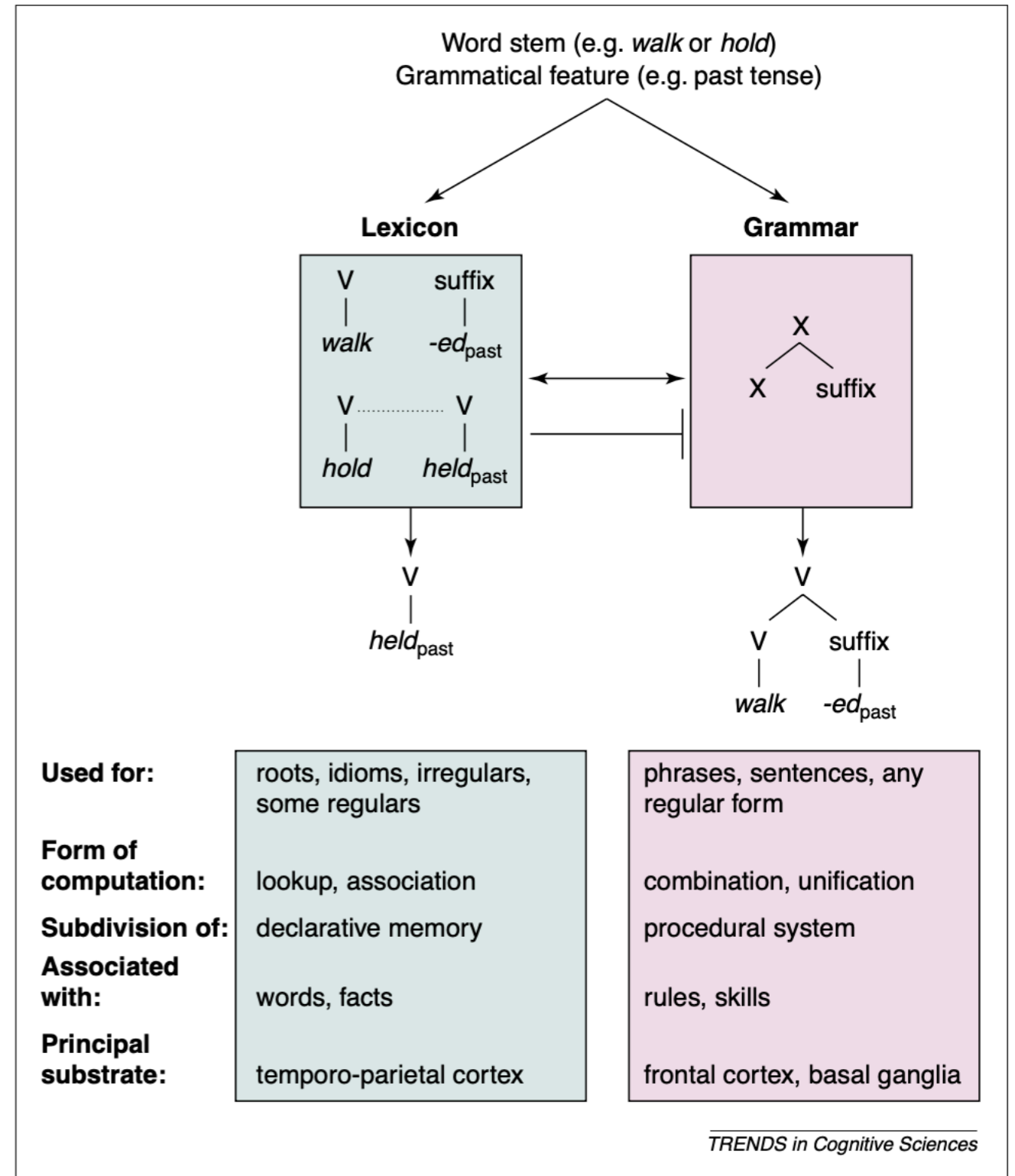
- Higher-order units can be computed “on the fly” by combining lower-order units according to certain set of rules/constraints.
 - Efficient storage, not so efficient process.
- But higher-order units may be stored as a unit in memory for later reuse as well.
 - Efficient process, not so efficient storage.

Storage and computation: past tense

- Discuss: comprehension/production of 'walked' (past tense of 'walk') and 'held' (past tense of 'hold') in terms of storage vs. computation.

Storage and computation: past tense

- Possibility of having both lookup-table like memory AND rule-based computations.
- People may efficiently use both mechanisms to deal with predictables and unpredictable?



Storage and computation: idioms

- “kick the bucket”, “pop the question”, etc.
- Idioms are (seemingly) complex linguistic object
-> possible involvement of combinatorial mechanisms?
- But idiom meanings are not predictable from the meaning of their parts -> clear involvement of memory as a whole.

Idiom production: Cutting & Bock (1997)

Memorize two phrases.

If you see '1', recall the first phrase.

If you see '2', recall the second phrase.

1. Kick the bucket
2. Meet your maker

Idiom production: Cutting & Bock (1997)

Idiom production: Cutting & Bock (1997)

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Idiom production: Cutting & Bock (1997)

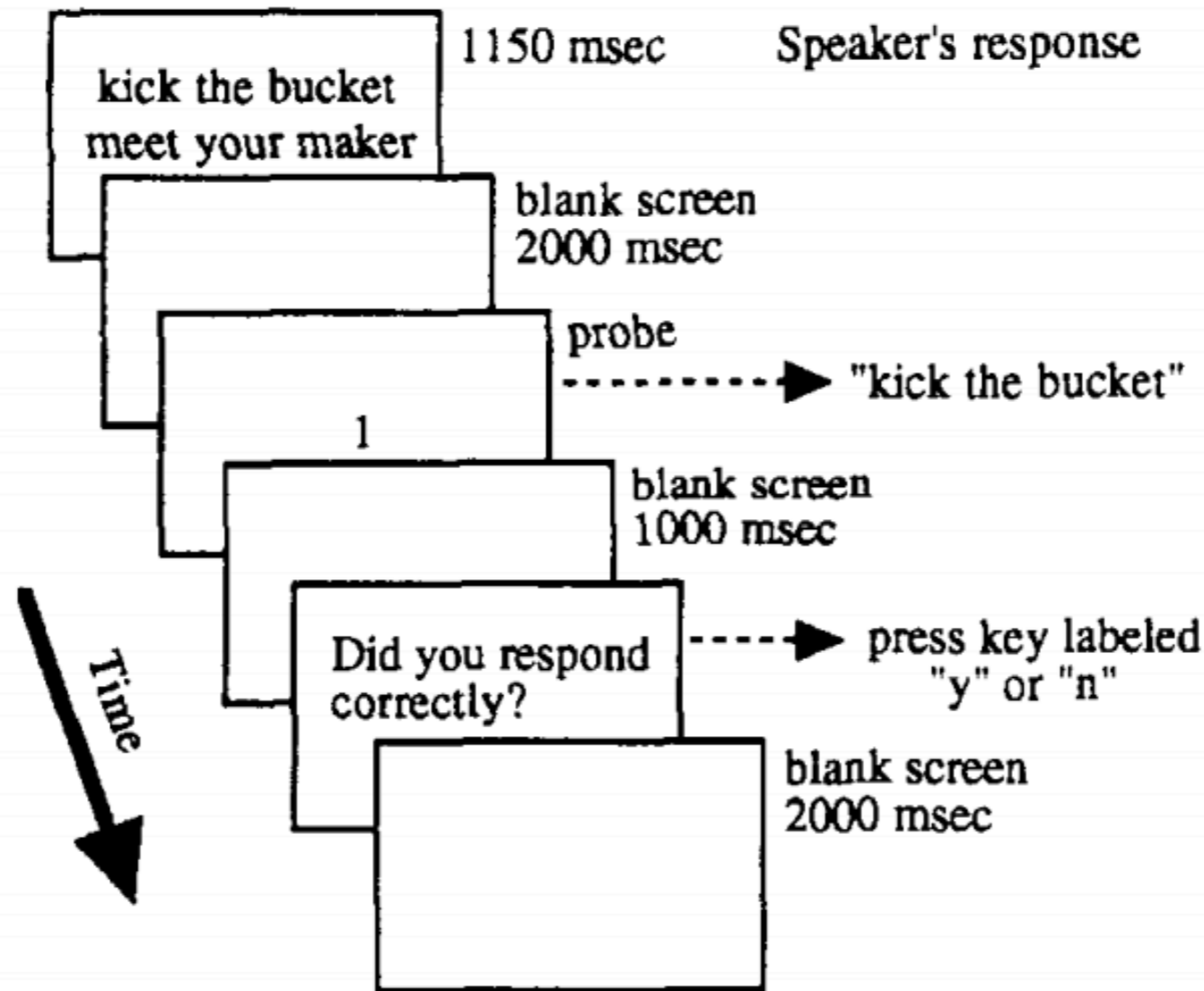


Figure 1. A representative experimental trial.

Idiom production: Cutting & Bock (1997)

Table 2
Examples of Error Categories for the Idiom Pair
“Kick the Bucket” and “Meet Your Maker”

Error Category	Example Errors
Idiom blend	
Addition	kick the bucket maker
Substitution	kick the maker
Intra-idiom	
Addition	kick the bucket over
Deletion	kick bucket
Movement	bucket the kick
Substitution	kick the rock
Intertrial	
Addition	kick the bucket around*
Substitution	kick the millstone*
Complex	kick the big rock
Miscellaneous	kick the something

*The idiom *millstone around your neck* occurred in one of the previous three trials.

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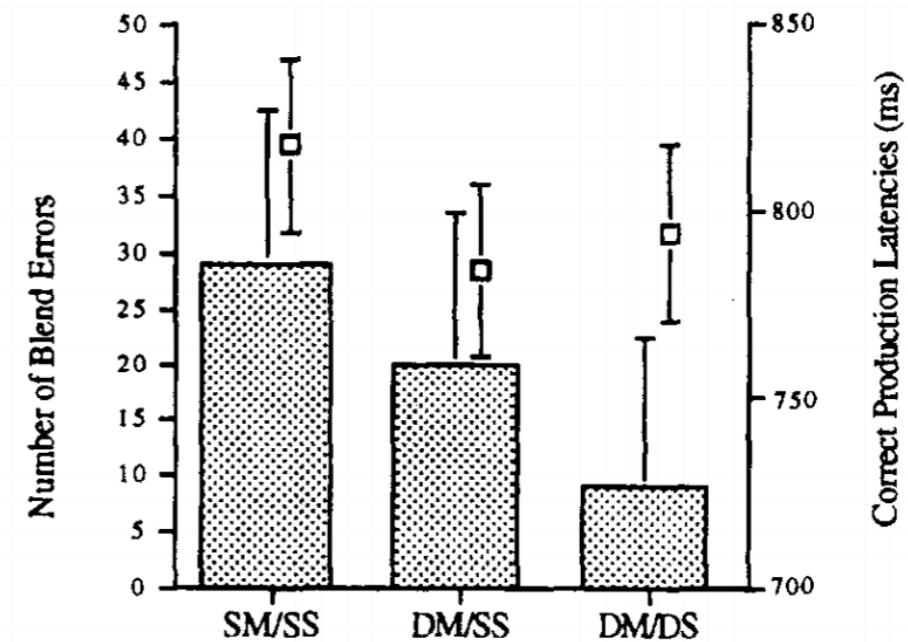


Figure 2. Correct response latencies and idiom blends in Experiment 1. The three conditions are same meaning–same syntax (SM/SS), different meaning–same syntax (DM/SS), and different meaning–different syntax (DM/DS). The bars represent the blend errors, and the individual box points represent the naming times. The error bars reflect confidence intervals for the Tukey tests.

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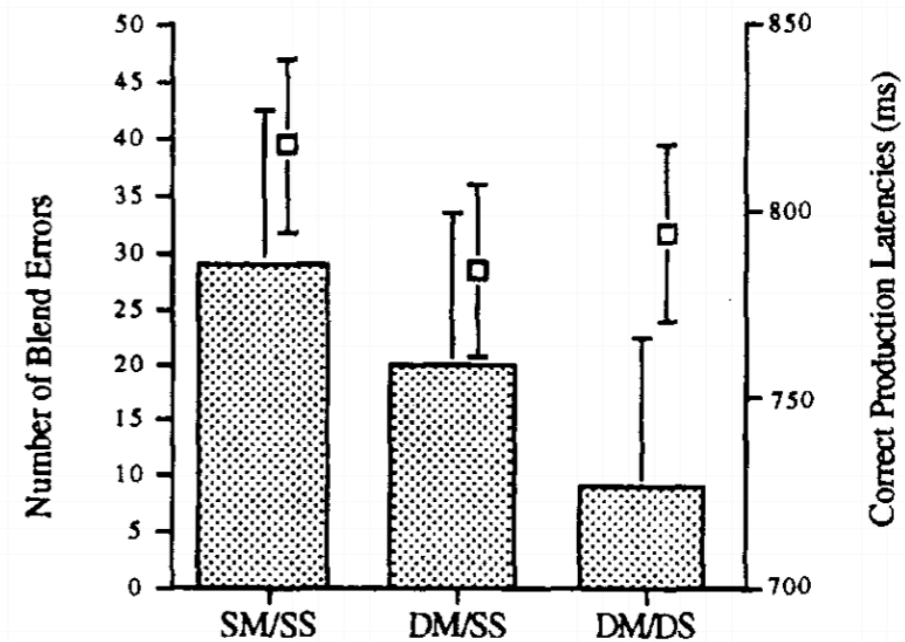


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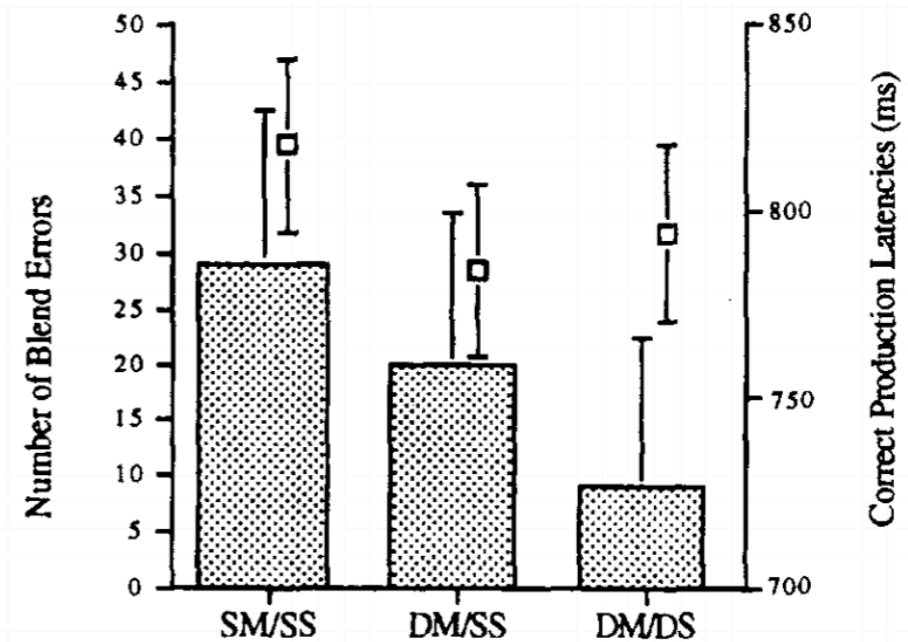


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- Blend errors more likely for syntactically (and semantically) similar idioms.
- The overwhelming majority of substitution cases involve substitutions of the words of the same syntactic category.
- Internal syntactic structures are generated and represented in idiom production?

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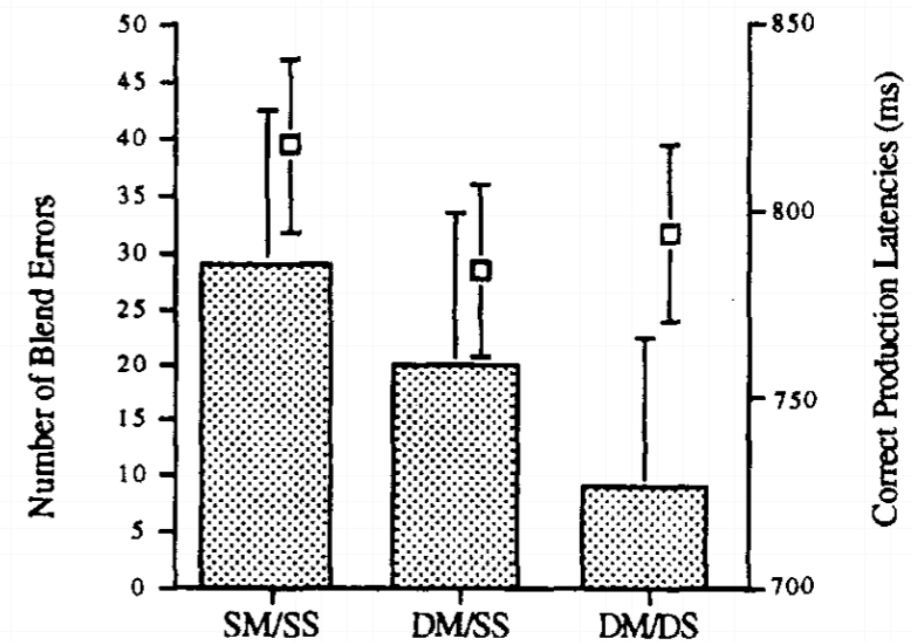


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- Speech error data should be treated with cautions, as they do not necessarily generalize to non-erroneous production.
- How do you test the same idea in non-erroneous production?

Idiom production: Sprenger et al. (2008)

Learn the following word-phrase pair. Later in the test phrase, you will be provided with the first word later, based on which you need to recall the paired phrase ASAP.

John - used the bucket

Emily - bit the bullet

Mary - rode the boat

Bill - zipped your lip

*In the actual experiment, it was in Dutch, and people had to memorize 8 pairs, but they studied those pairs more extensively.

Idiom production: Sprenger et al. (2008)

Recall the associated phrase ASAP.

Emily

Idiom production: Sprenger et al. (2008)

Recall the associated phrase ASAP.

Bill

Idiom production: Sprenger et al. (2008)

Recall the associated phrase ASAP.

Mary

Idiom production: Sprenger et al. (2008)

Recall the associated phrase ASAP.

John

Idiom production: Sprenger et al. (2008)

	Cue	Target	Prime
Literal	John	- used the bucket	mail (unrelated)
Idiom	Emily	- bit the bullet	table (unrelated)
Literal	Mary	- rode the boat	boat (identical)
Idiom	Bill	- zipped your lip	lip (identical)

Idiom production: Sprenger et al. (2008)

	Cue	Target	Prime
Idiom	John	-kicked the bucket	mail (unrelated)
Literal	Emily	-removed the bullet	table (unrelated)
Idiom	Mary	- missed the boat	boat (identical)
Literal	Bill	- cleaned your lip	lip (identical)

Idiom production: Sprenger et al. (2008)

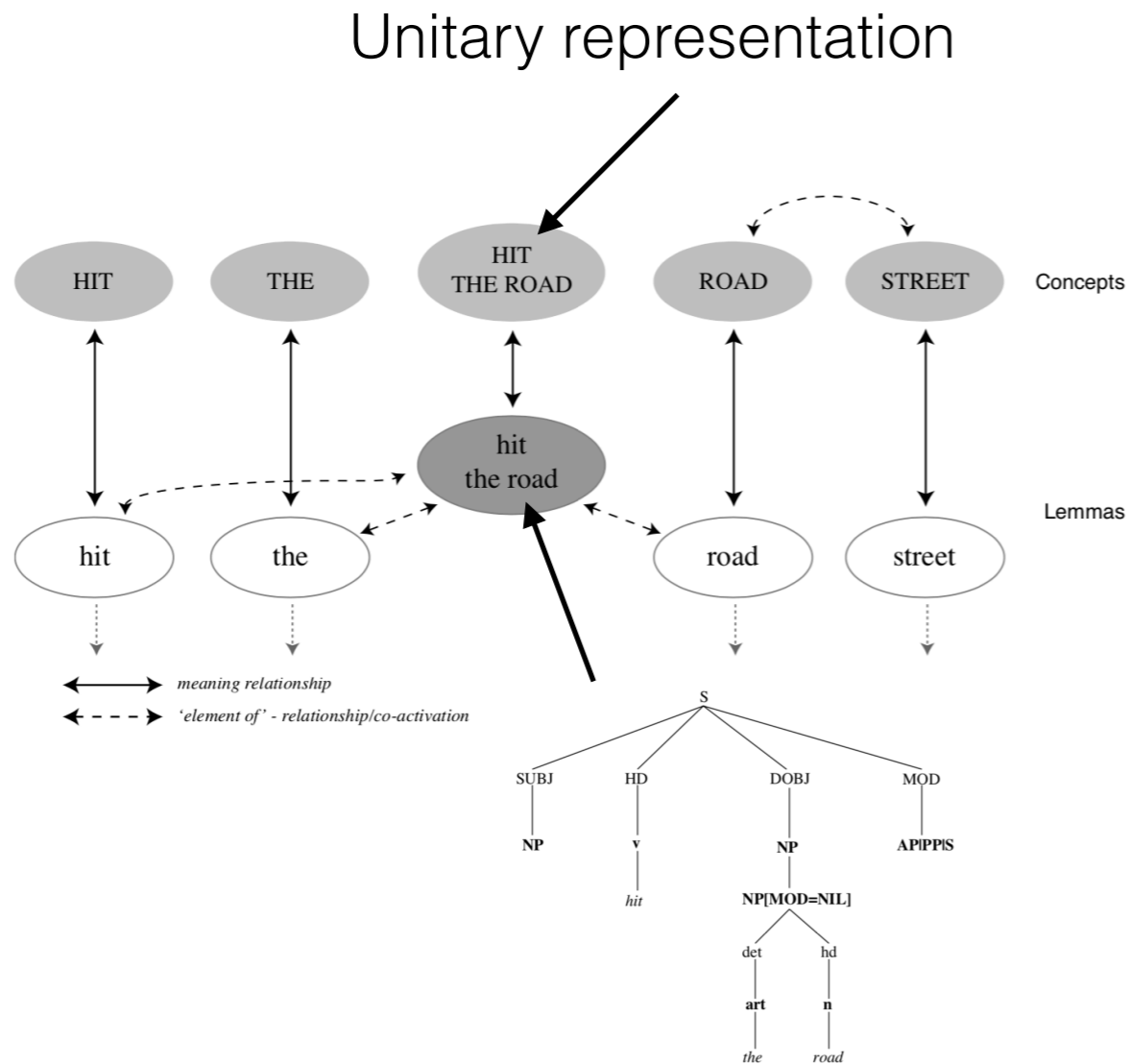
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Table 1
Mean production latencies and standard deviations in Experiment 1

Idiomatity	Prime type	
	Unrelated	Identity
Literal	890 (155)	833 (156)
Idiomatic	922 (167)	807 (145)

57 ms priming effect
115 ms priming effect

Storage and computation: idiom production



- Capturing the dual nature of idioms:
 - Unitary at conceptual level
 - Internally complex at lemma (syntactic) level
- Priming effect at the two levels can add up (= larger effect of identity priming in idioms).

Internally complex “superlemma” representation
(connected to parts)

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- Idioms are complex linguistic object -> involvement of combinatorial mechanisms.
- But idiom meanings are not predictable from the meaning of their parts -> involvement of memory as a whole.

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- Computation: use combinatorial mechanism to generate complex representations.
- Memory: store complex unit as a whole and access them from memory.

Storage and computation

- Discussion: Can you think of other linguistic phenomena where the same/similar issues can be found?