Do syllables exist? Psycholinguistic evidence for the retrieval of syllabic units in speech production

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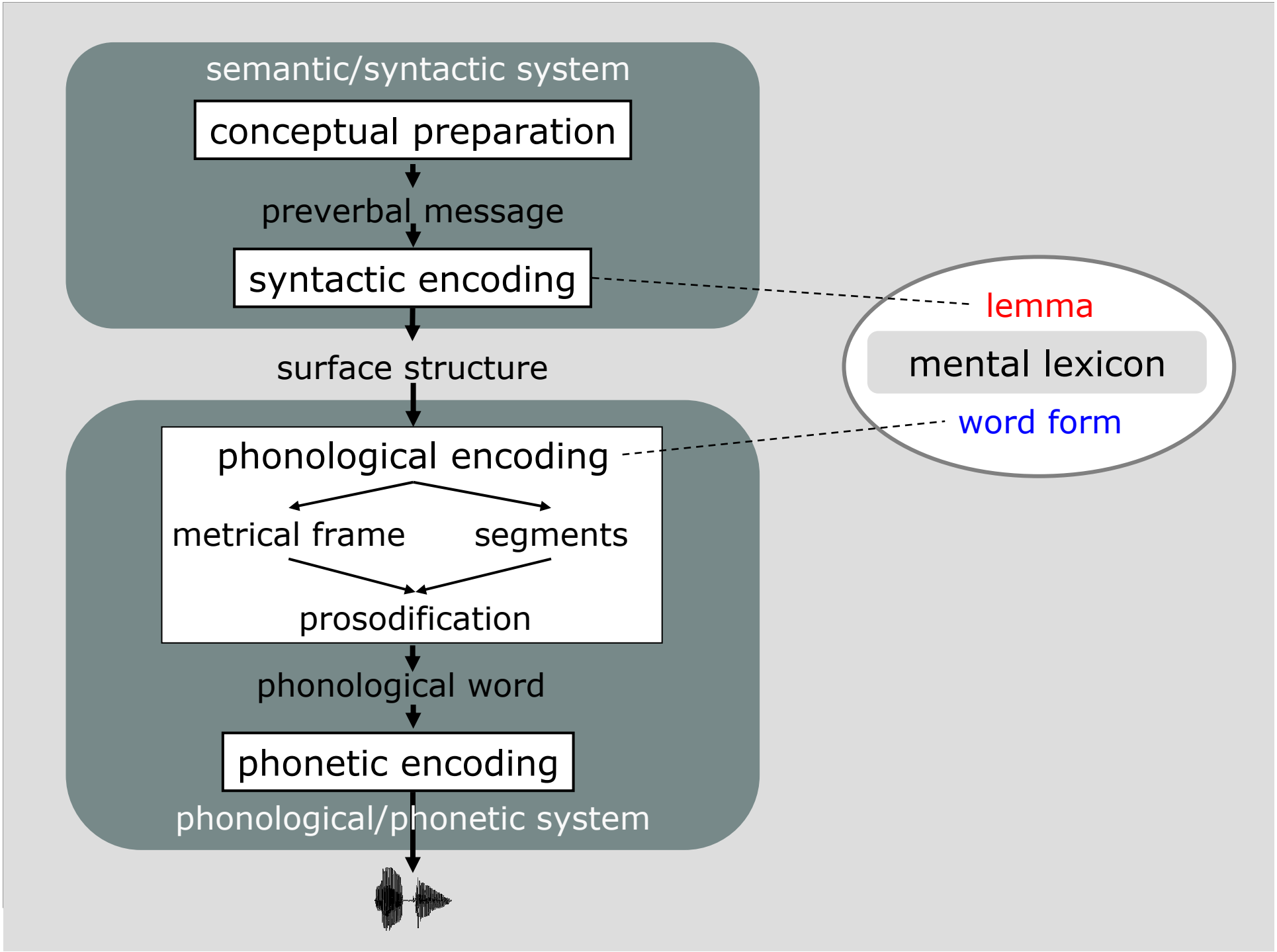
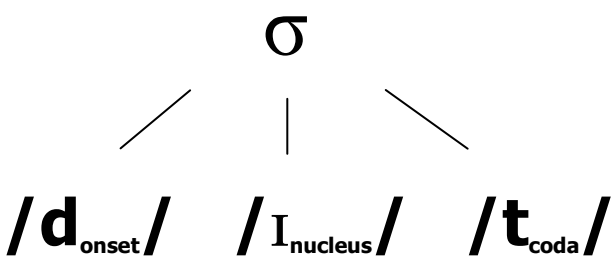
Does the syllable constitute an independent unit that is accessed during speech production planning processes?

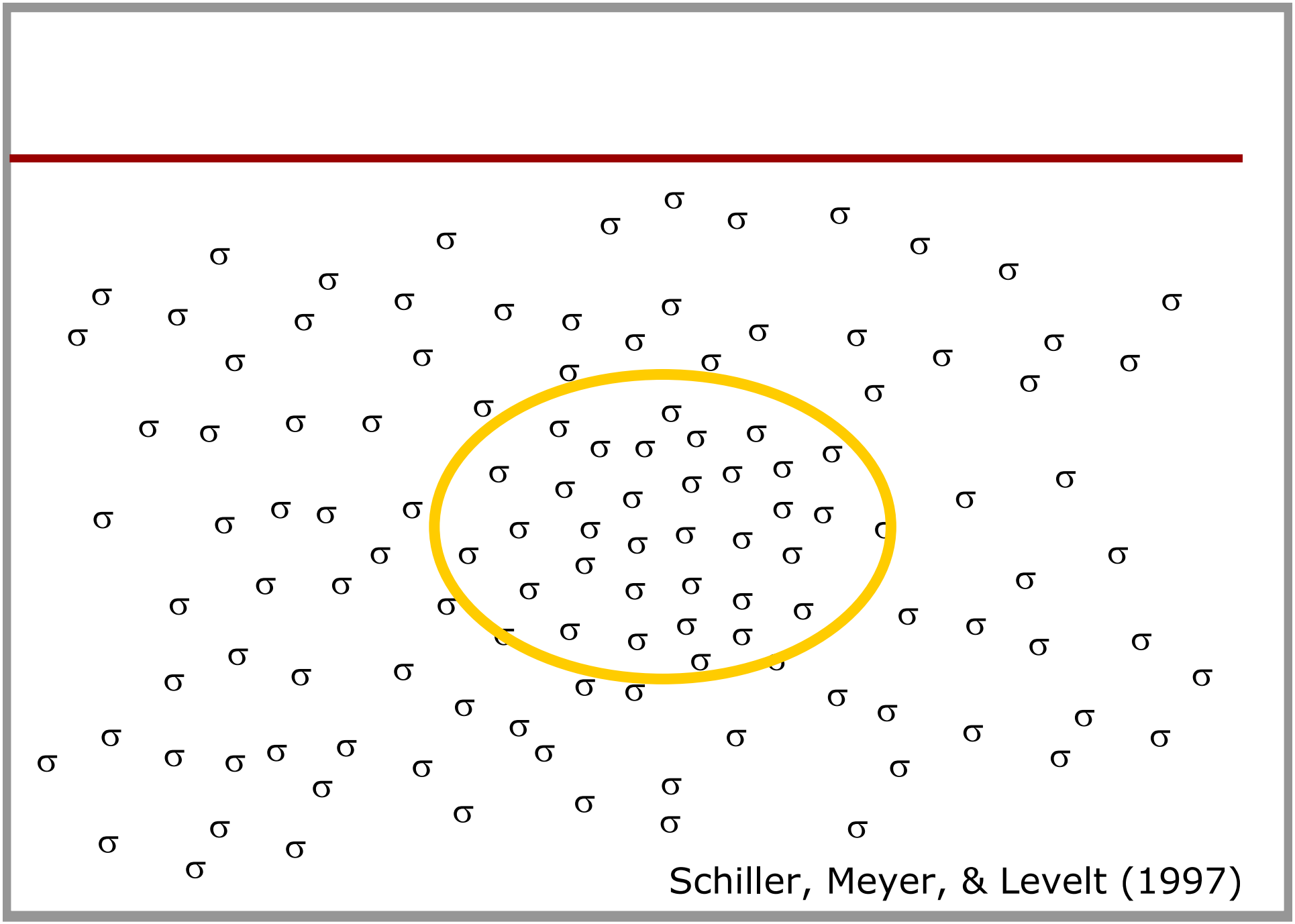

semantic/syntactic system
conceptual preparation
preverbal message
syntactic encoding
surface structure
phonological encoding
metrical frame
segments
prosodification
phonological word
phonetic encoding
phonological/phonetic system
lemma
mental lexicon
word form

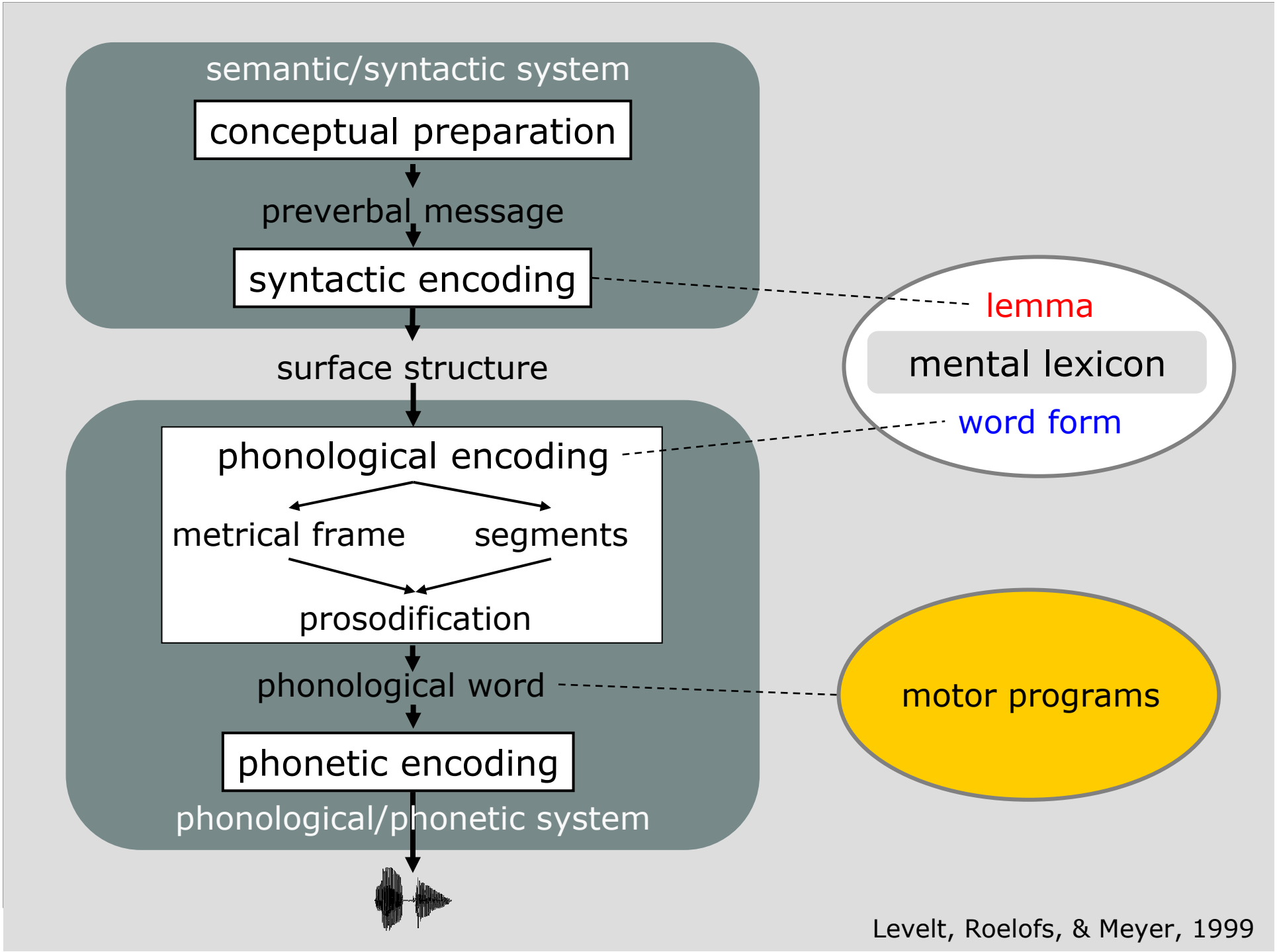
syllables in fluent connected speech

demand it → "de-man-dit"

"σ - σ - σ"

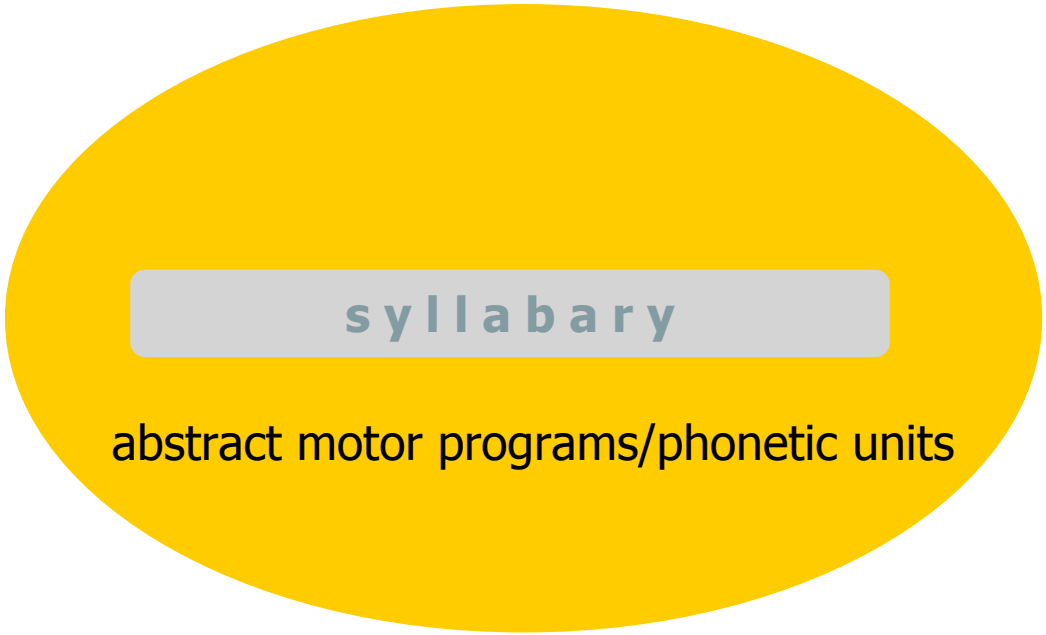



Schiller, Meyer, & Levelt (1997)



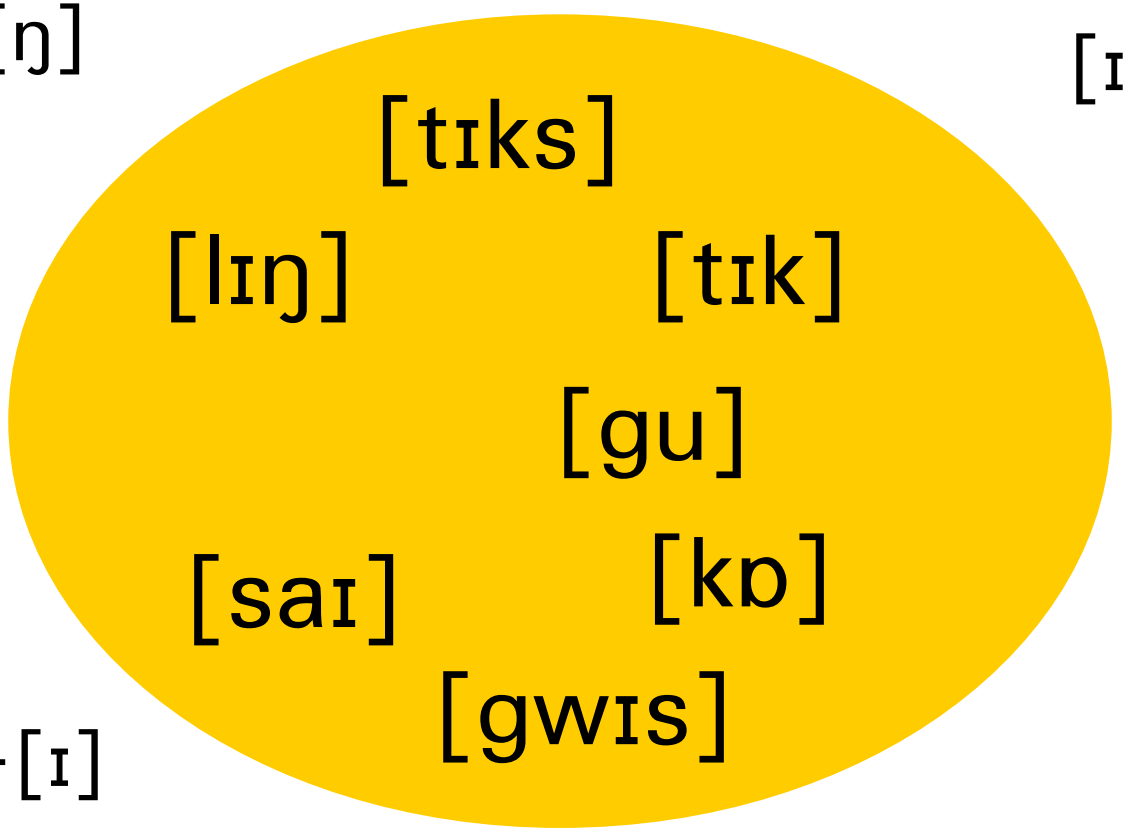
Levelt, Roelofs, & Meyer, 1999

DO SPEAKERS HAVE ACCESS TO A MENTAL SYLLABARY?



frequency effects

a mental syllabary?



[l]+[ɪ]+[ŋ]

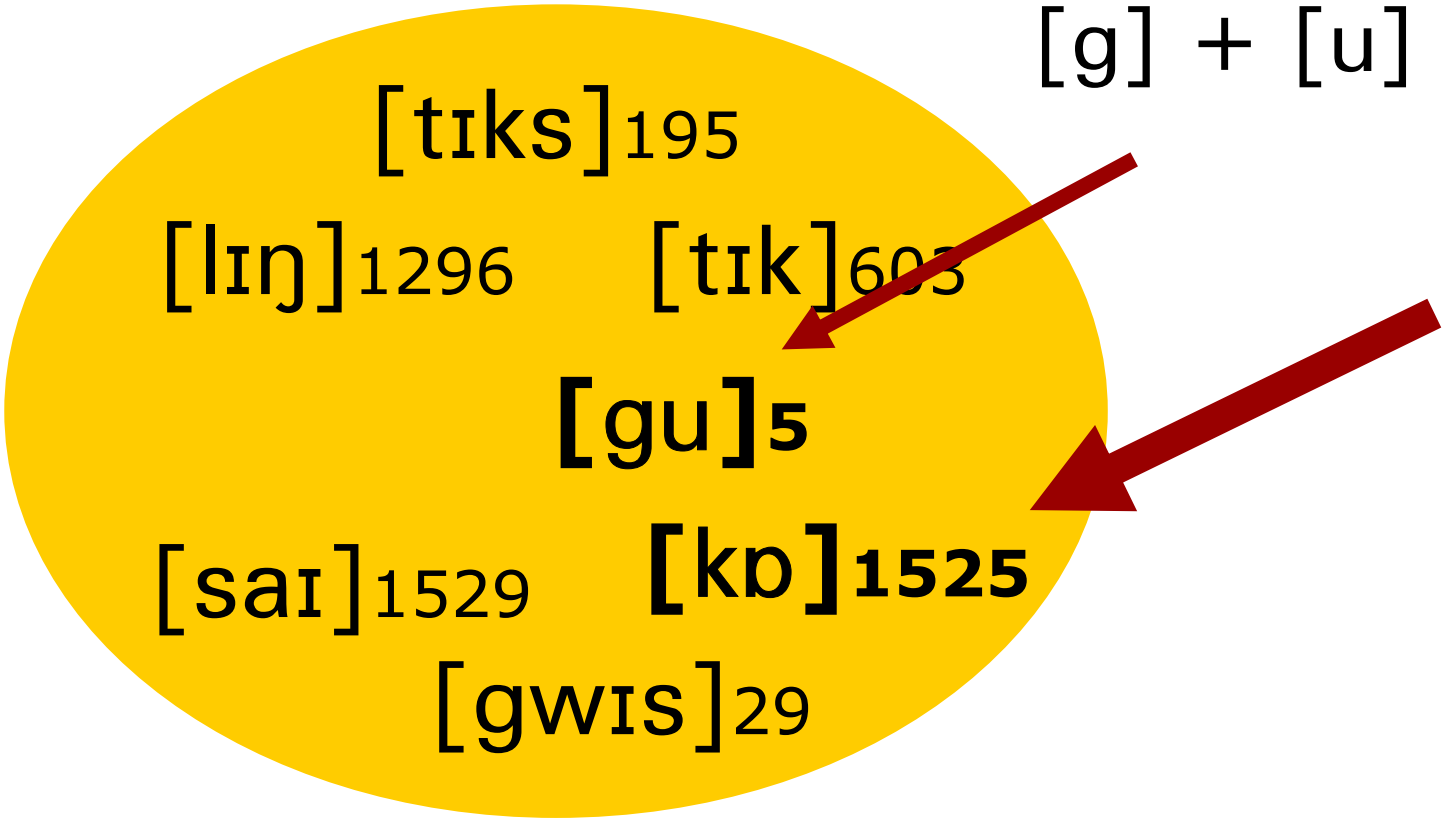
[ɪ]+[s]

[k]+[ɒ]

[s]+[a]+[ɪ]

[t]+[ɪ]+[k]+[s]

effects of syllable frequency



effects of syllable frequency

investigations in two languages that might have different syllable transparency:

a) in Dutch
   (relatively clear syllable boundaries)

b) in English
   (less clear syllable boundaries)

effects of syllable frequency

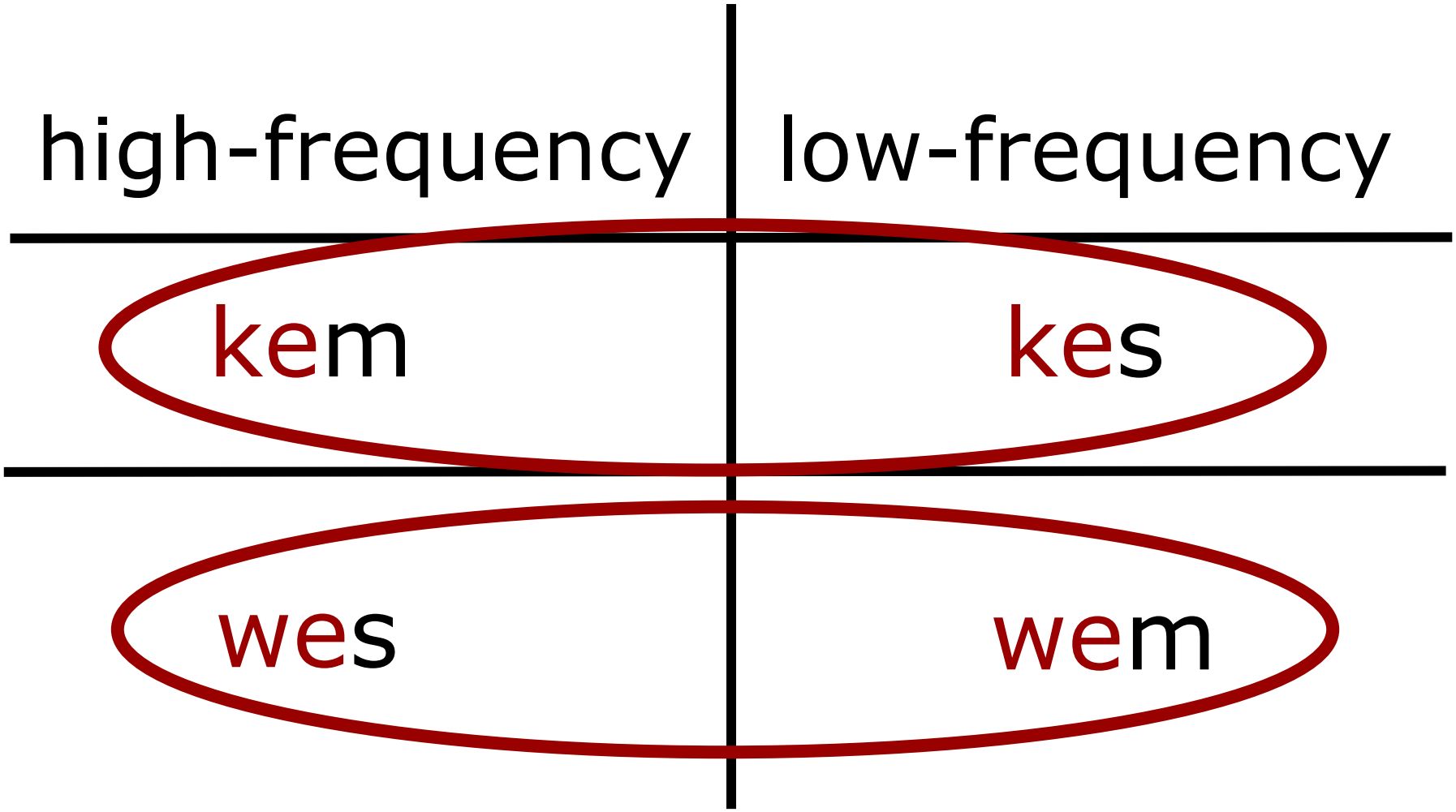
high- vs. low-frequency syllables need to be controlled for:

- CV-structure
- phoneme length
- phoneme frequency
- biphone frequency (transitions)

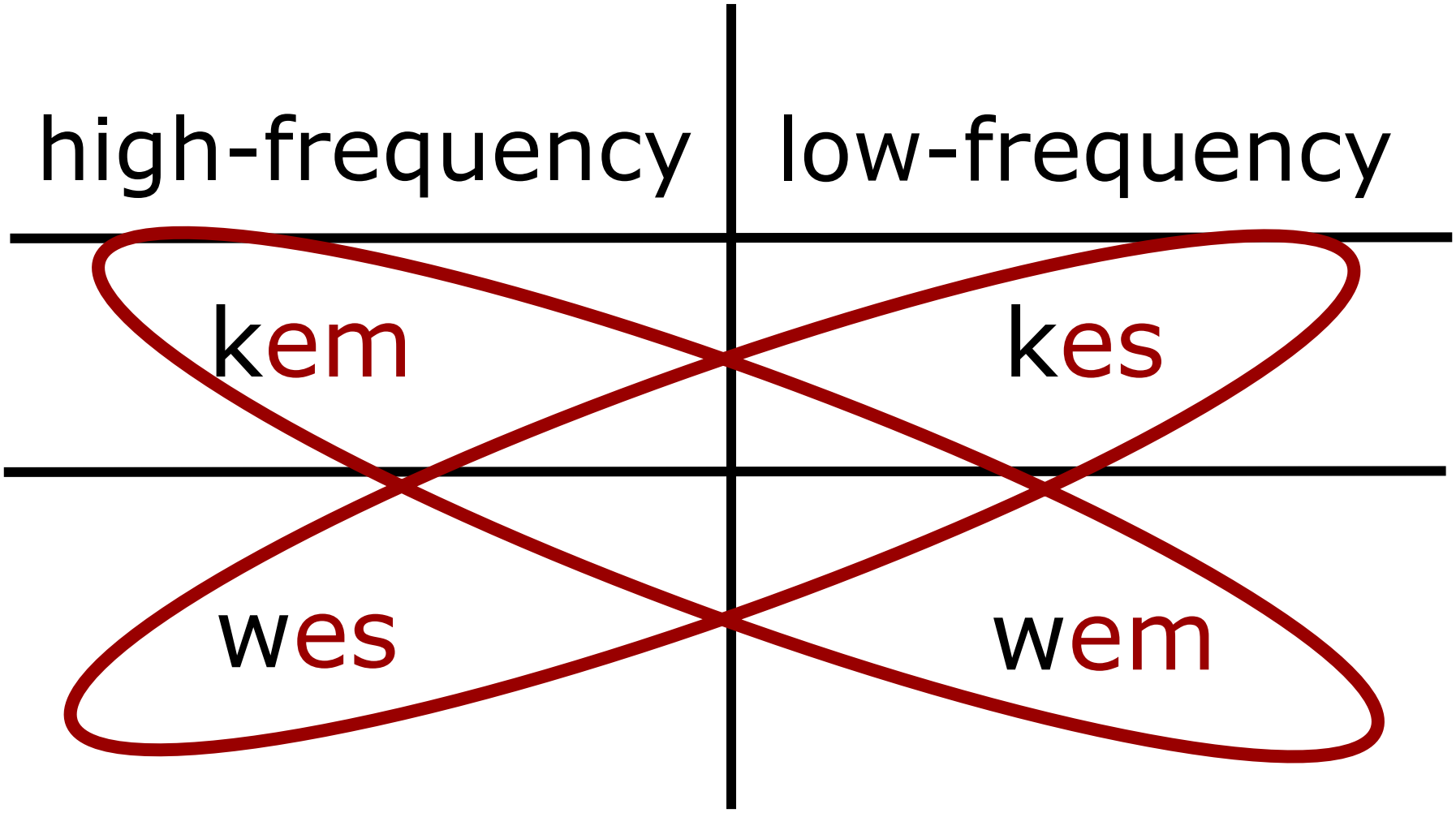
material: syllabic quartets

high-frequency	low-frequency
kem [kɛm]	kes [kɛs]
wes [vɛs]	wem [vɛm]

material: syllabic quartets



material: syllabic quartets



symbol-position-association paradigm

learning phase

= “kem”

= “tur”

symbol-position-association paradigm

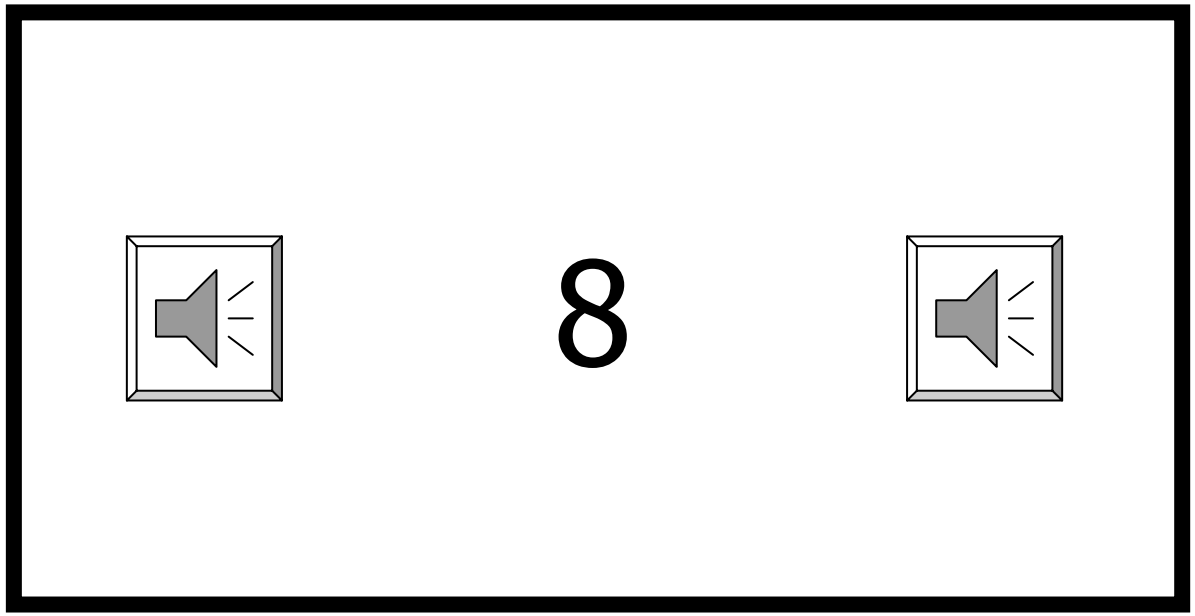
practice phase

= “kem”

= “tur”

symbol-position-association paradigm

test phase



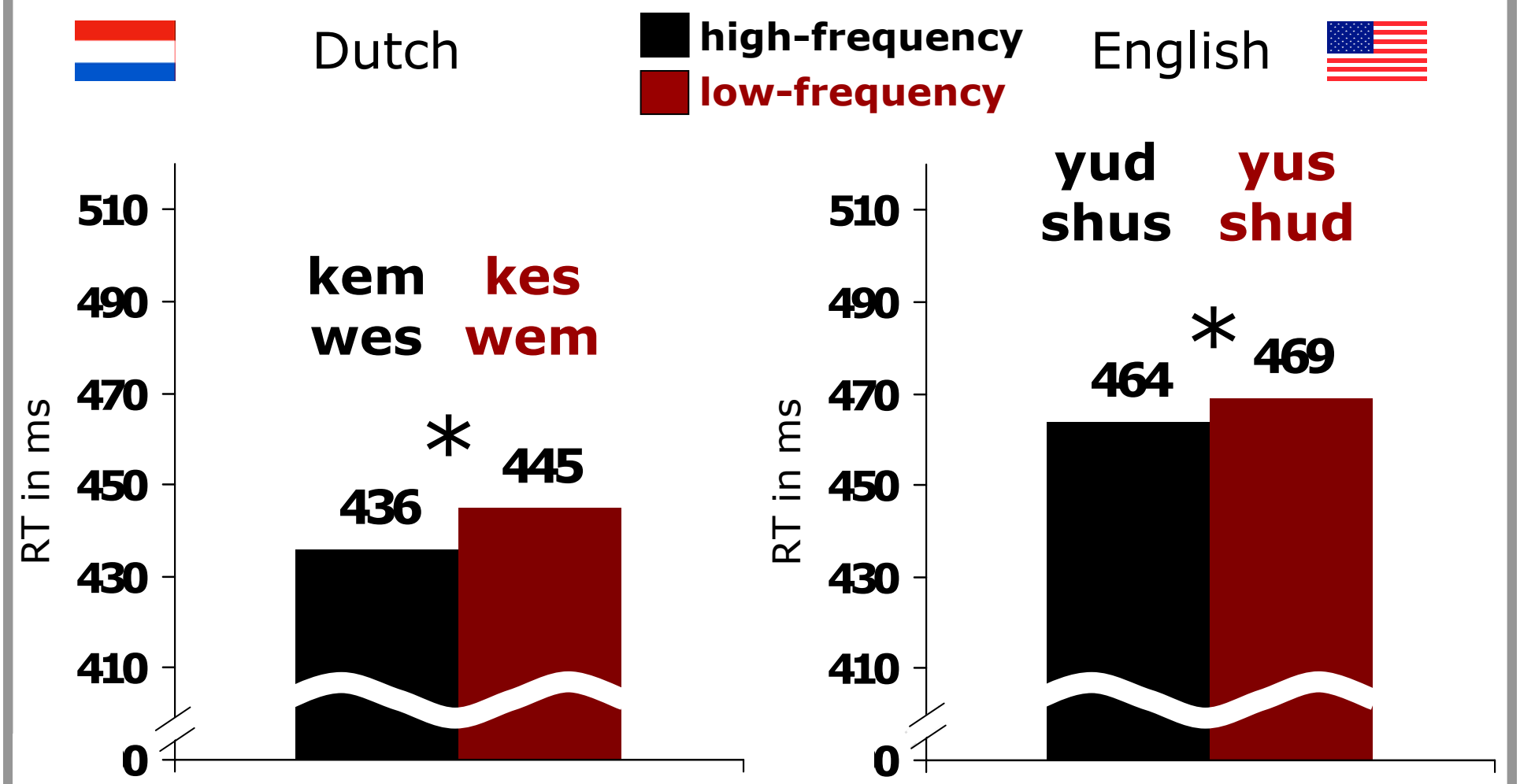
“kem” “eight” “tur”

effects of syllable frequency

- 8 quartets (32 syllables, 16 HF & 16 LF syllables)
- 8 high- and 8 low-frequency sets
- 8 repetitions per syllable per set
- acoustic versions of the syllables were spoken by a female native speakers
- high- and low-frequency sets alternated, no phonological overlap within or between (directly succeeding sets)

high-frequency:	kem	-	tur
low-frequency:	kes	-	tug

monosyllabic pseudo-words



syllable frequency studies

French: Alario, Ferrand, Laganaro, New, Frauenfelder, & Segui, 2004; Brand, Rey, Peereman, & Spieler, 2002; Laganaro, 2002; Laganaro & Alario, 2006;

Spanish: Carreiras & Perea, 2004; Perea & Carreiras, 1996

English: Cholin, Dell, & Levelt, in prep.; Croot & Rastle; 2004; Monsell, van der Lugt, & Jessiman, 2002;

Dutch: Cholin, Levelt, & Schiller, 2006; Levelt & Wheeldon, 1994

German: Aichert & Ziegler, 2004

syllable frequency studies

production of Dutch and English high-frequency monosyllabic pseudo-words is significantly faster than for low-frequency counterparts

these results strongly support the notion of a mental syllabary that contains pre-compiled whole motor programs for syllables

effects for both languages suggest that syllabic motor programs are stored independent of the "syllable transparency"

a mental *syllabary*?

syllable frequency effects are neutral with respect to an additional/alternative "online-assembly route": syllable frequency effects do not exclude that there are other units stored in the syllabary, smaller and larger than the syllable

possibly hierachical, non-linear structures
(Aichert & Ziegler, 2007; Ziegler, 2005, 2007; Lee & Goldrick, 2007)

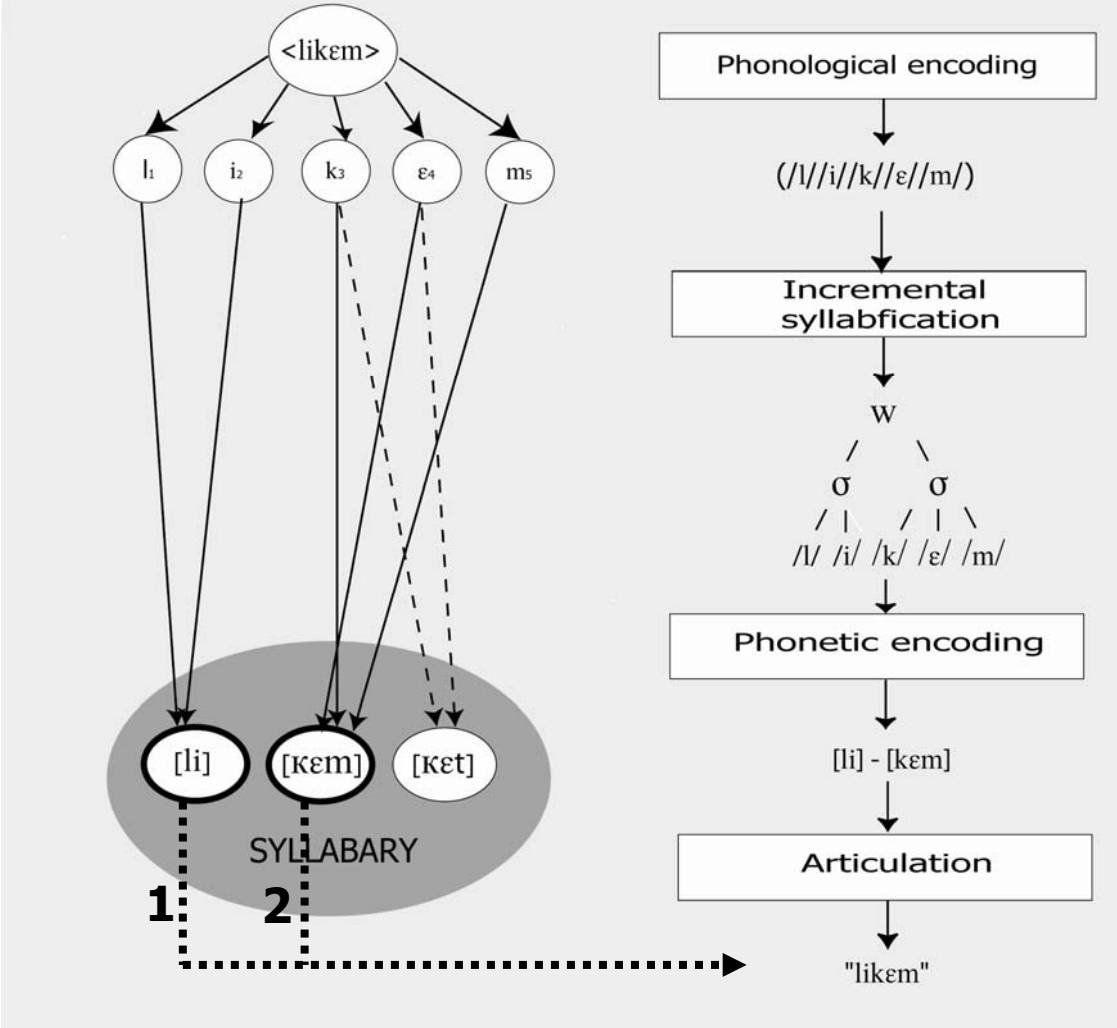
open questions

- how abstract/concrete are the packages? how much fine-tuning is left to subsequent steps of phonetic encoding
- a "dual mechanism" storage vs. computation?
- activation/competition/selection in the mental syllabary
- neighborhood effects
- storage of new syllables; a bi-/multilingual mental syllabary
- communication between the encoding levels and the articulatory network (within the production system) as well as between production and perception

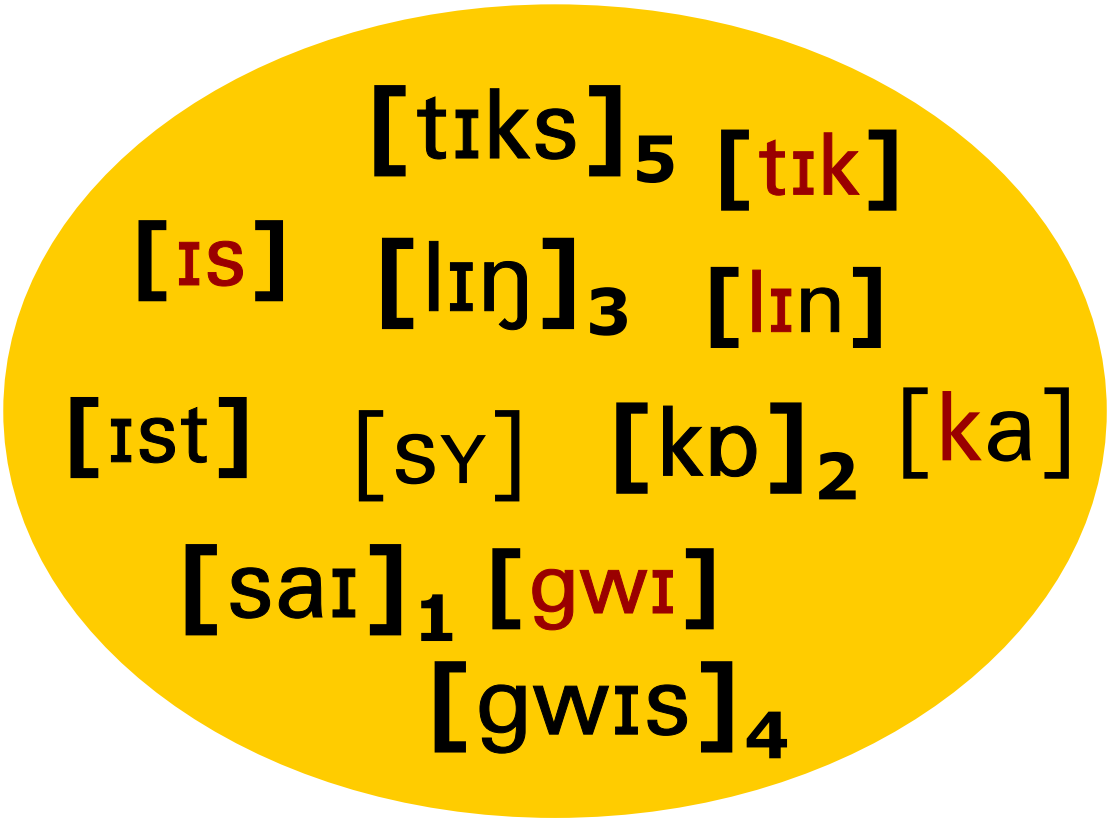
→ syllable frequency effects in disyllabic (pseudo-)words?

coordination of planning and articulation of syllabic units

incremental generation of syllables



activation in the mental syllabary

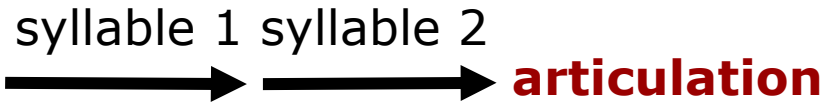


[saɪ’] [kɒ] [lɪŋ] [gwɪs] [tɪks]

manipulation of 1. versus 2. syllable frequency

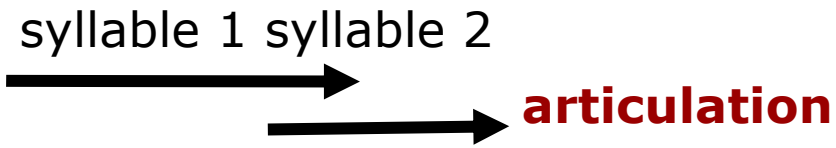
Levelt and Wheeldon, 1994, p. 254: [...] speakers cannot or will not begin to articulate the word before its phonetic encoding is complete."

li.kem



retrieval of subsequent syllables is not dependent on the retrieval of the preceding syllable

li.kem



→ **temporal overlap**

syllable frequency effects in disyllabic pseudo-words?

	high-frequency	low-frequency
Experiment 2	kem.li [ˈkɛm.li]	kes.li [ˈkɛs.li]
	wes.li [ˈvɛs.li]	wem.li [ˈvɛm.li]
Experiment 3	li.kem [li.ˈkɛm]	li.kes [li.ˈkɛs]
	li.wes [li.ˈvɛs]	li.wem [li.ˈvɛm]

experiment 2

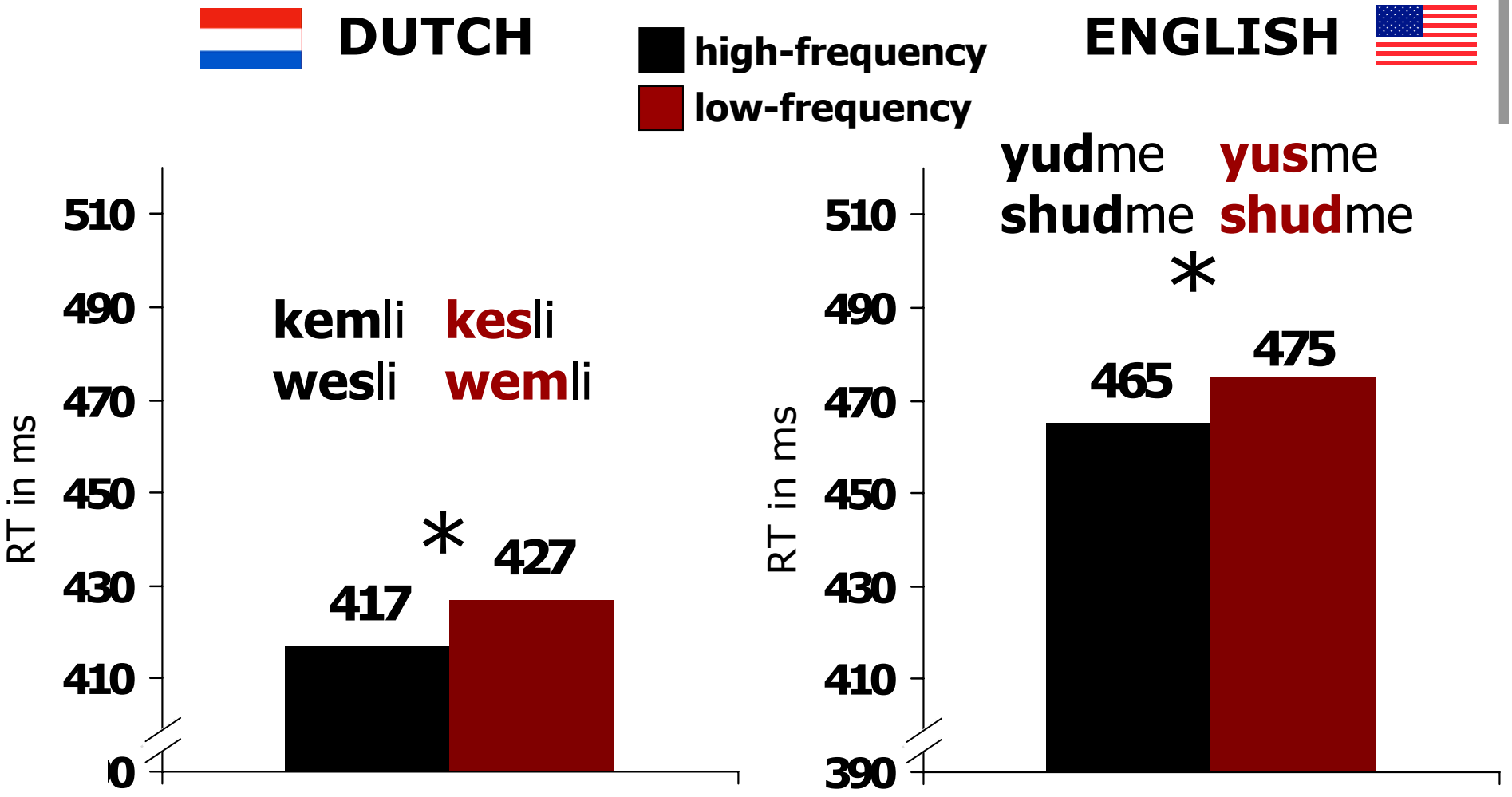
frequency manipulation on the 1. syllable

HF – LF

kem.li – kes.li

wes.li – wem.li

disyllabic pseudo words with the frequency manipulation on the first syllable



disyllabic pseudo words with the frequency manipulation on the first syllable

the production of Dutch and English disyllabic pseudo-words containing high- and low-frequency **first** syllables revealed significant syllable frequency effects

these results clearly contradict the predictions by Levelt and Wheeldon (1994) that only the second syllable shows frequency effects

experiment 3

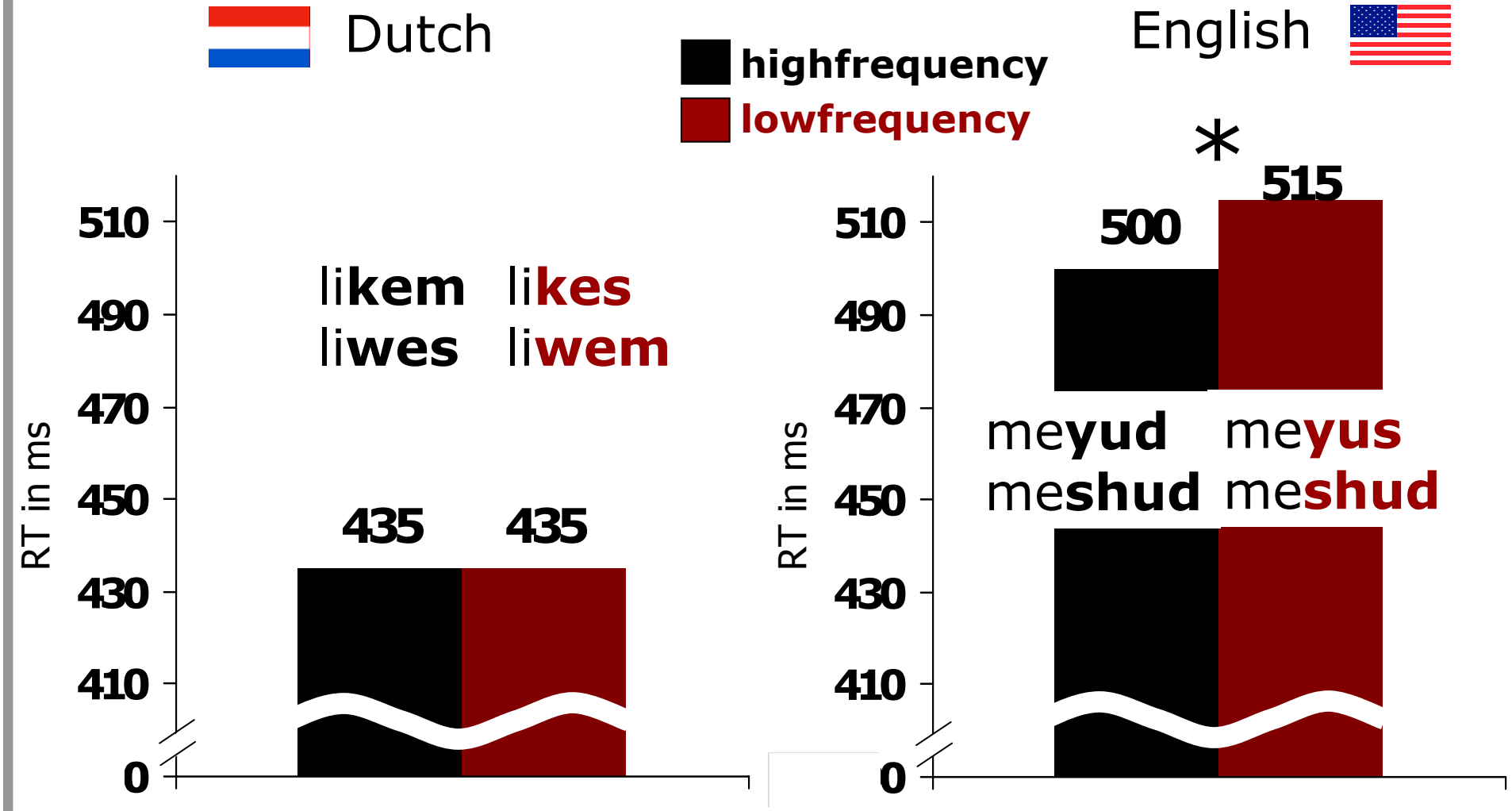
frequency manipulation on the 2. syllable

HF – LF

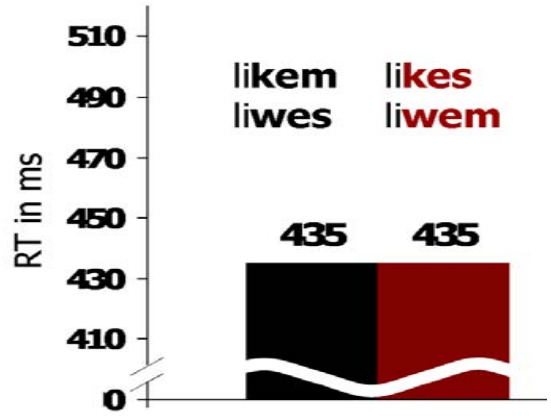
li.kem – li.kes

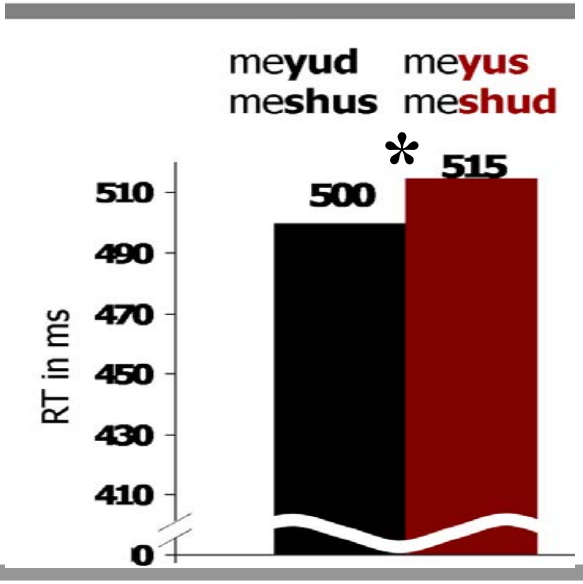
li.wes – li.wem

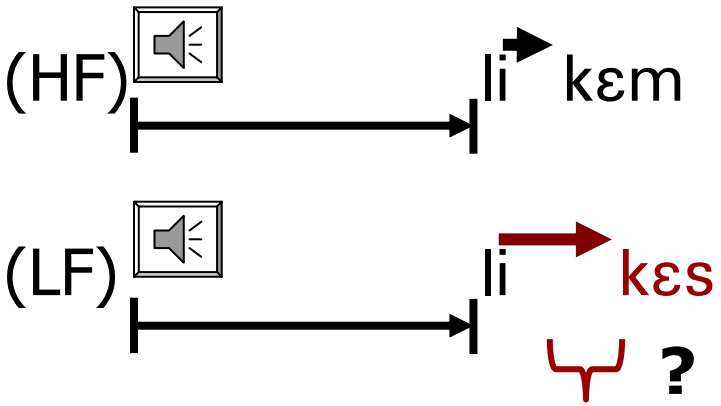
disyllabic pseudo words with the frequency manipulation on the second syllable



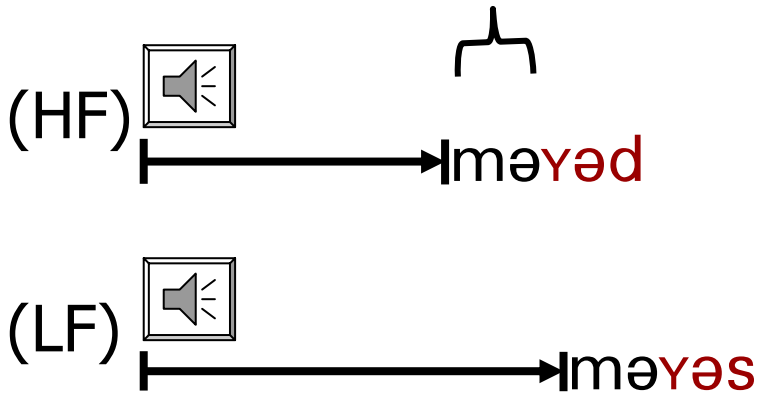
Dutch vs. English







syllable frequency effect



interim summary

- significant syllable frequency effects for pseudo-words in Dutch and English
- results strongly support the notion of a mental syllabary that contains pre-compiled motor programs for syllables
- evidence that articulation can be initiated already after the first syllable is encoded

cross-linguistic difference?

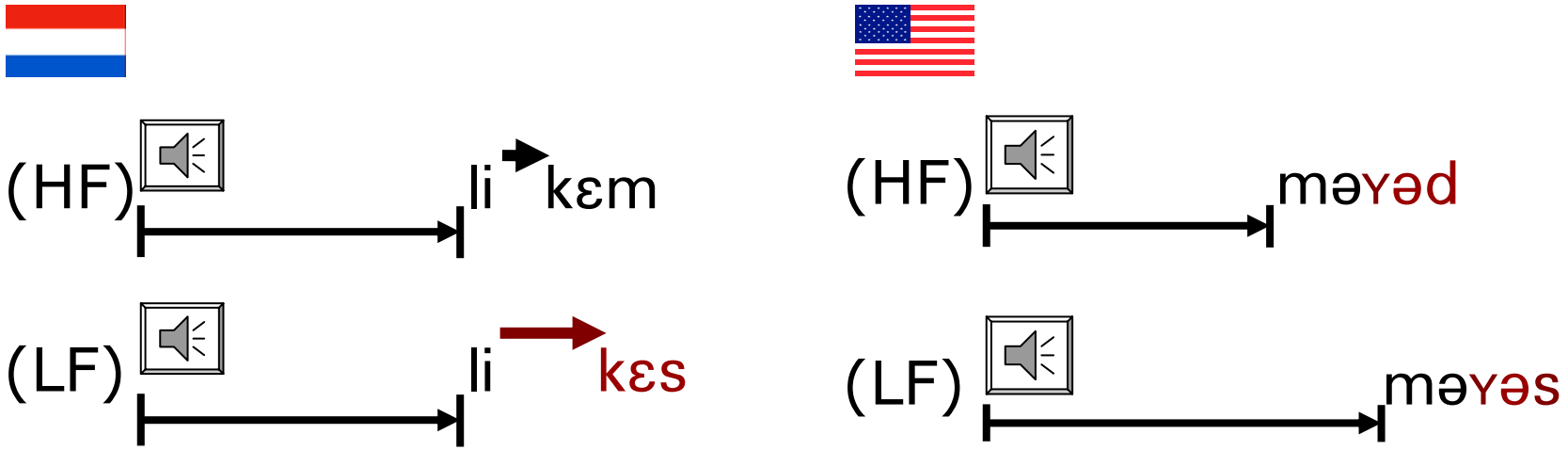
different size of planning units for articulation in languages that might have more/less transparent syllable boundaries?

Dutch uses *syllables* as minimal unit whereas
English uses *feet* as (minimal) incremental articulation units?

potential differences between the Dutch and the English material

Dutch: liː.kem (long vowel)

English: mə.yud (reduced vowel)



language difference or difference in the material set?

experiment 4

replication with English disyllabic pseudo words with first syllables that contain long vowels/diphthongs:

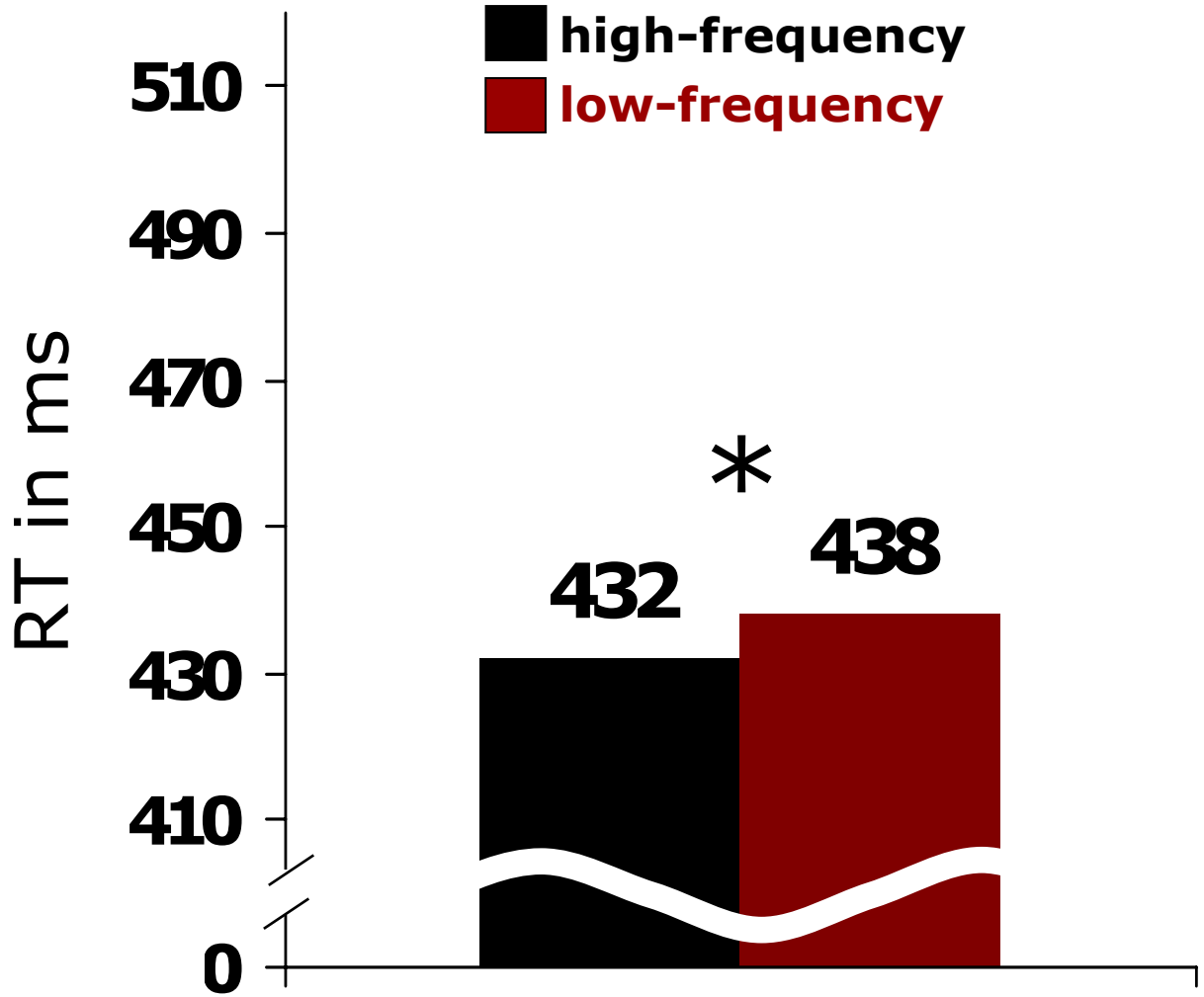
(HF) [maː.ˈʏəd]

(LF) [maː.ˈʏəs]

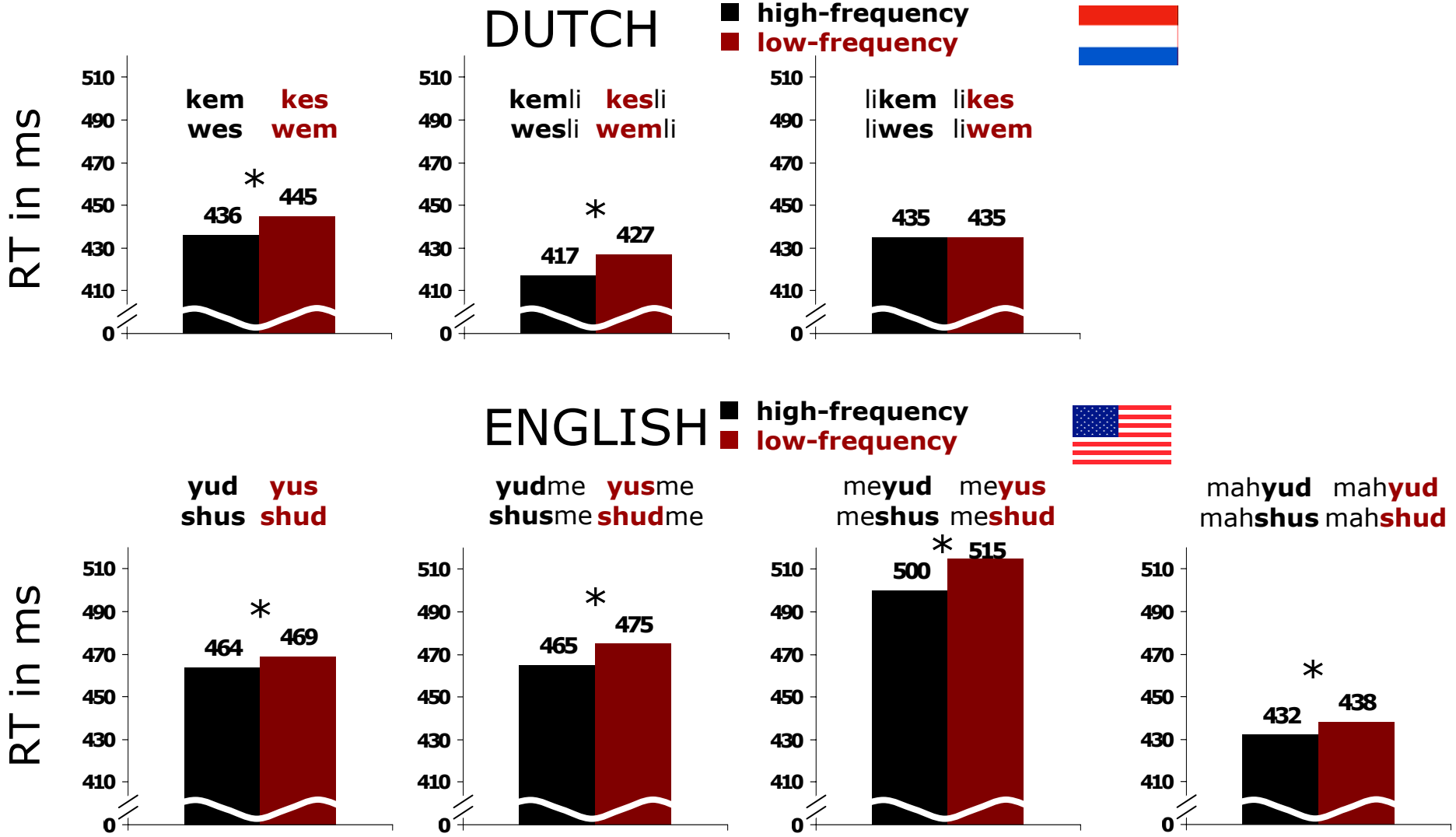
(HF) [maː.ˈʃəs]

(LF) [maː.ˈʃəd]

experiment 4



syllable frequency effects



syllable frequency effects

speakers incrementally generate syllable after syllable and articulation can start with the first syllable before the second syllable is also available for production

(thereby excluding potential effects of the second syllable in Dutch)

in English the syllable frequency of both the first and the second syllable influenced production times; speakers might use larger planning units for articulation

syllable frequency effects

evidence that the syllable constitutes an independent unit in Dutch and English

(independent of the transparency of the language‘s syllables)

transparency, however, may have an influence on the coordination of incremental planning and articulatory units

speakers seem to have flexible planning units for articulation → further investigation of influencing factors

thank you

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